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Vinson&Elkins

ATTORNEYS AT LAW

VINSON & ELKINS L.L.P.
2300 FIRST CITY TOWER
1001 FANNIN STREET
HOUSTON, TEXAS 77002-6760
TELEPHONE (713) 758-2222
FAX (713) 758-2346

Writer's Phone: (713) 758-2528
Writer's Fax: (713) 615-5316

E-mail: cdinkins@velaw.com
Web: www.velaw.com

October 24, 2000

VIA OVERNIGHT COURIER

Patricia Hick, Esq.
Assistant Regional Counsel, Office of Regional Counsel
U.S. Environmental Protection Agency - Region 2
290 Broadway, 19th Floor - Room W-20
New York, NY 10007-1866

In Re: Passaic River Study Area:
Request for Information on the Creel Angler Survey

Dear Ms. Hick:

During our telephone conference on October 10, 2000, as followup to our meeting with Richard Caspe on October 4, you requested the items listed below. Herein we provide our initial response and a description of the status of our response to the remainder of the requests not provided by this letter.

1. **Revised Creel Angler Survey Work Plan.**

   Enclosed is a copy of the Creel Angler Survey Work Plan, revised October 23, 2000 (hereinafter Revised Work Plan), which reflects all of the changes deemed necessary as a result of the pre-test activities conducted with residents of the local communities.

2. **New survey documents.**

   The new survey documents (or "instruments" or "questionnaires") are included as a part of the Revised Work Plan. These questionnaires reflect the results of pre-testing conducted with residents of the local communities.

3. **Information on the Pre-testing, e.g., (a) number of participants, (b) how participants were selected, and (c) conclusions reached based on pretesting.**

   The information gleaned from the pre-testing activities has not yet been reduced to a written report. However, CLH's consultants used what was gleaned in pre-testing to develop the Revised Work Plan. As you might expect, revising the Work Plan had a higher priority than

priority than preparation of a formal write-up of the pre-test activities. As soon as this write-up is complete (anticipated to be within the next 1-2 weeks), we will forward a copy of the same to you for evaluation.

4. **Summary of survey results to-date.**

Summary tables of survey results to-date are included as Attachment A to this letter.

5. **Field survey schedules: You inquired as to when surveys had been conducted thus far and how the random schedules were generated.**

The former is contained in the summary of survey results to-date, and provided in response to item 4, above. The latter is described in the Revised Work Plan, a copy of which is enclosed with this letter as noted in response to item 1 above.

6. **Information on future schedules for intercepts: You asked how far into the future intercepts are scheduled.**

The Revised Work Plan contains the survey schedule through the end of this month. Due to the process of dynamically updating the next month's schedule based on the prior months' results (described in the Revised Plan), CLH does not schedule father than one month in advance.

7. **Locations where people were found: You inquired whether CLH has intercepts at places other than the few where it already expected to find people, e.g. PATH and Hess.**

As a result of the dual-mode of surveying (i.e., boat-counts of anglers and separate interviews), CLH knows, empirically, where people are angling. This information is incorporated into the interview process by including known, popular angling locations.

To date, two anglers have been found at the two locations identified below, neither of which had been previously selected for on-site interviews. Due to the limited impact (i.e., one occurrence each out of more than 250 counts over 33 days), and in the absence of any evidence of repeat occupancy of the location, the interview locations will not be adjusted as a result of these observations:

- August 2, 2000: 1 person on west bank of Passaic River between Conrail Bridge and Lincoln Highway Bridge

- September 13, 2000 - 1 person on east bank of Passaic River on PATH property

8. **You requested that as soon as the Expert Panel for peer review had met, that we transmit information concerning its composition.**

Following is a list of members of the Expert Panel. The person previously identified for expertise in statistics had to decline participation due to scheduling conflicts. Therefore, as soon as a replacement statistician is identified, he/she will be included in subsequent panel activities.

- Dr. Paul Kostecki, Association for Environmental Health and Sciences - Executive Director
  Role: Moderator/Facilitator

- Dr. Barry Johnson, Emory University/AEHS Associate/Editor-in-Chief of "Human and Ecological Risk Assessment"
  Expertise: Risk assessment

- Dr. Ed Calabrese, University of Massachusetts/AEHS Associate
  Expertise: Risk assessment

- Dr. Christopher Teaf, President and Director of Toxicology
  Hazardous Substance and Waste Management Research, Inc.
  Expertise: Risk assessment

- Dr. Kevin Boyle, University of Maine
  Expertise: Creel Angler Studies

We appreciate your continuing consideration of this important matter. Please do not hesitate to call if you have any questions or need any additional information.

Very truly yours,

Carol Dinkins

Carol E. Dinkins

ced:lme
Houston:363602.1

cc: Dave Rabbe (w/o enclosures)
Cliff Firstenberg (w/o enclosures)
Tony Wolfskill (w/o enclosures)

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Summary Results of Passaic River Creel/Angler Survey

Category	Data
Total Number of Count Days Spent on the River	38
Total Number of Exit Interview Days	27
Exit Interview Days as Percentage of Total Count Days	71%
Total Number of Counts Conducted on the River	298
Total Number of Days With Fishing Activity on the River	30
Fishing Activity on the River as a Percentage of Total Count Days	79%
Maximum Number of Anglers Counted on the River During any One Counting Run	10
Total Number of Anglers Intercepted for Exit Interviews	47
Total Number of Anglers Agreeing to Complete Exit Interviews	32
Exit Interview Response Rate	68%
Total Number of Missed Creel Reports	15
Total Number of Anglers Catching Fish or Crabs (includes Missed Creel Reports)	35
Percentage of Total Anglers Intercepted for Exit Interviews	74%
Total Number of Anglers Keeping Fish or Crabs	16
Percentage of Anglers Catching Fish or Crabs	46%

October 23, 2000

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Weekly Creel/Angler Survey Status Report - All Months

Date	Counts	Exits	Exit Location	# of Counts	Fishing Activity on River	Location(s) of Fishing Activity	Max Individual Angler Count	Total # of Angler Obs.	# of Anglers Intercepted	# of Interviews	# Missed Reports	# of Anglers Catching Fish/Crab	# of Anglers Keeping Fish/Crab
8/2/2000	1	0	NA	8	1	4, 7-8	2	4	NA	NA	NA	NA	NA
8/4/2000	1	1	Hess	10	1	2, 6	1	5	0	0	0	0	0
8/6/2000	1	0	NA	8	1	2, 4	5	23	NA	NA	NA	NA	NA
8/8/2000	1	1	RBP-Kearny	8	1	6	1	1	0	0	0	0	0
8/12/2000	1	1	Hess	6	1	4	2	4	2	0	2	0	0
8/16/2000	1	0	NA	8	1	2, 4	3	9	NA	NA	NA	NA	NA
8/17/2000	1	0	NA	8	1	2	1	1	NA	NA	NA	NA	NA
8/19/2000	1	1	RBP-Kearny	8	1	2, 4, 6	8	18	1	1	0	1	0
8/20/2000	1	1	Hess	8	1	4	4	23	7	7	0	6	3
8/23/2000	1	1	Hess	8	1	4	3	5	4	3	1	2	1
8/24/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
8/26/2000	1	0	NA	8	1	4,6	1	4	NA	NA	NA	NA	NA
8/27/2000	1	1	Hess	6	1	3, 4, 5, 6	10	42	5	4	1	4	4
8/28/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
8/29/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
8/31/2000	1	1	RBP-Kearny	8	1	4	1	2	0	0	0	0	0

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Weekly Creel/Angler Survey Status Report - All Months

Date	Counts	Exits	Exit Location	# of Counts	Fishing Activity on River	Location(s) of Fishing Activity	Max Individual Angler Count	Total # of Angler Obs.	# of Anglers Intercepted	# of Interviews	# Missed Reports	# of Anglers Catching Fish/Crab	# of Anglers Keeping Fish/Crab
9/1/2000	1	1	Hess	8	1	4	3	7	5	4	1	3	0
9/3/2000	1	1	RBP-Kearny	8	1	4,6	4	26	0	0	0	0	0
9/4/2000	1	0	NA	8	0	0	0	0	NA	NA	NA	NA	NA
9/5/2000	1	0	NA	8	0	0	0	0	NA	NA	NA	NA	NA
9/6/2000	1	1	Hess	8	1	1,4	3	5	1	1	0	1	0
9/9/2000	1	1	RBP-Ironbound	8	1	4	3	12	0	0	0	0	0
9/13/2000	1	0	NA	8	1	6,6-7	2	8	NA	NA	NA	NA	NA
9/16/2000	1	1	Hess	8	1	4,6	3	28	5	3	2	4	2
09/18/00	1	0	NA	8	1	6	1	2	NA	NA	NA	NA	NA
09/22/00	1	1	Hess	8	1	4	1	2	1	0	1	1	1
09/23/00	1	0	NA	8	1	3,4,6	9	46	NA	NA	NA	NA	NA
09/24/00	1	1	Hess	8	1	4	6	34	10	5	5	9	4
09/25/00	1	1	Heliport	8	0	0	0	0	0	0	0	0	0
09/27/00	1	1	RBP-Kearny	8	1	4	1	1	0	0	0	0	0
09/28/00	1	1	Pathmark	8	1	4	1	4	0	0	0	0	0
10/01/00	1	1	Hess	6	1	4	2	7	3	2	1	2	0
10/02/00	1	1	RBP-Ironbound	6	0	0	0	0	0	0	0	0	0
10/07/00	1	0	NA	8	1	4,2	3	8	0	0	0	0	0

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Weekly Creel/Angler Survey Status Report - All Months

Date	Counts	Exits	Exit Location	# of Counts	Fishing Activity on River	Location(s) of Fishing Activity	Max Individual Angler Count	Total # of Angler Obs.	# of Anglers Intercepted	# of Interviews	# Missed Reports	# of Anglers Catching Fish/Crab	# of Anglers Keeping Fish/Crab
10/10/00	1	1	Hess	8	0	0	0	0	0	0	0	0	0
10/13/00	1	1	Hess	8	1	4	4	14	3	2	1	2	1
10/14/00	1	1	RBP - Kearny	8	1	4	2	6	0	0	0	0	0
10/15/00	1	1	Heliport	8	1	4	1	2	0	0	0	0	0
Total	**38**	**27**	**-**	**298**	**30**	**-**	**10**	**353**	**47**	**32**	**15**	**35**	**16**

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Weekly Creel/Angler Survey Status Report - August

Date	Counts	Exits	Exit Location	# of Counts	Fishing Activity on River	Location(s) of Fishing Activity	Max Individual Angler Count	Total # of Angler Obs.	# of Anglers Intercepted	# of Interviews	# Missed Reports	# of Anglers Catching Fish/Crab	# of Anglers Keeping Fish/Crab
8/2/2000	1	0	NA	8	1	4, 7-8	2	4	NA	NA	NA	NA	NA
8/4/2000	1	1	Hess	10	1	2, 6	1	5	0	0	0	0	0
8/6/2000	1	0	NA	8	1	2, 4	5	23	NA	NA	NA	NA	NA
8/8/2000	1	1	RBP-Kearny	8	1	6	1	1	0	0	0	0	0
8/12/2000	1	1	Hess	6	1	4	2	4	2	0	2	0	0
8/16/2000	1	0	NA	8	1	2, 4	3	9	NA	NA	NA	NA	NA
8/17/2000	1	0	NA	8	1	2	1	1	NA	NA	NA	NA	NA
8/19/2000	1	1	RBP-Kearny	8	1	2, 4, 6	8	18	1	1	0	1	0
8/20/2000	1	1	Hess	8	1	4	4	23	7	7	0	6	3
8/23/2000	1	1	Hess	8	1	4	3	5	4	3	1	2	1
8/24/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
8/26/2000	1	0	NA	8	1	4,6	1	4	NA	NA	NA	NA	NA
8/27/2000	1	1	Hess	6	1	3, 4, 5, 6	10	42	5	4	1	4	4
8/28/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
8/29/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
8/31/2000	1	1	RBP-Kearny	8	1	4	1	2	0	0	0	0	0
Total	**16**	**11**	**-**	**126**	**13**	**-**	**10**	**141**	**19**	**15**	**4**	**13**	**8**

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Weekly Creel/Angler Survey Status Report - September

Date	Counts	Exits	Exit Location	# of Counts	Fishing Activity on River	Location(s) of Fishing Activity	Max Individual Angler Count	Total # of Angler Obs.	# of Anglers Intercepted	# of Interviews	# Missed Reports	# of Anglers Catching Fish/Crab	# of Anglers Keeping Fish/Crab
9/1/2000	1	1	Hess	8	1	4	3	7	5	4	1	3	0
9/3/2000	1	1	RBP-Kearny	8	1	4,6	4	26	0	0	0	0	0
9/4/2000	1	0	NA	8	0	0	0	0	NA	NA	NA	NA	NA
9/5/2000	1	0	NA	8	0	0	0	0	NA	NA	NA	NA	NA
9/6/2000	1	1	Hess	8	1	1,4	3	5	1	1	0	1	0
9/9/2000	1	1	RBP-Ironbound	8	1	4	3	12	0	0	0	0	0
9/13/2000	1	0	NA	8	1	6,6-7	2	8	NA	NA	NA	NA	NA
9/16/2000	1	1	Hess	8	1	4,6	3	28	5	3	2	4	2
09/18/00	1	0	NA	8	1	6	1	2	NA	NA	NA	NA	NA
09/22/00	1	1	Hess	8	1	4	1	2	1	0	1	1	1
09/23/00	1	0	NA	8	1	3,4,6	9	46	NA	NA	NA	NA	NA
09/24/00	1	1	Hess	8	1	4	6	34	10	5	5	9	4
09/25/00	1	1	Heliport	8	0	0	0	0	0	0	0	0	0
09/27/00	1	1	RBP-Kearny	8	1	4	1	1	0	0	0	0	0
09/28/00	1	1	Pathmark	8	1	4	1	4	0	0	0	0	0
Total	**15**	**10**	**-**	**120**	**12**	**-**	**9**	**175**	**22**	**13**	**9**	**18**	**7**

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Weekly Creel/Angler Survey Status Report - October

Date	Counts	Exits	Exit Location	# of Counts	Fishing Activity on River	Location(s) of Fishing Activity	Max Individual Angler Count	Total # of Angler Obs.	# of Anglers Intercepted	# of Interviews	# Missed Reports	# of Anglers Catching Fish/Crab	# of Anglers Keeping Fish/Crab
10/1/2000	1	1	Hess	6	1	4	2	7	3	2	1	2	0
10/2/2000	1	1	RBP-Ironbound	6	0	0	0	0	0	0	0	0	0
10/7/2000	1	0	NA	8	1	4,2	3	8	0	0	0	0	0
10/10/2000	1	1	Hess	8	0	0	0	0	0	0	0	0	0
10/13/2000	1	1	Hess	8	1	4	4	14	3	2	1	2	1
10/14/2000	1	1	RBP - Kearny	8	1	4	2	6	0	0	0	0	0
10/15/2000	1	1	Heliport	8	1	4	1	2	0	0	0	0	0
Total	**7**	**6**	**-**	**52**	**5**	**-**	**4**	**37**	**6**	**4**	**2**	**4**	**1**

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Description of Weekly Status Report Categories

Column	Heading Description
Date	Date of counts and exit interviews
Counts	1 = counts took place on that day; 0 = no counts took place
Exits	1 = exit interviews took place on that day; 0 = no interviews took place (i.e., not an exit-interview day--count only day)
Exit Location	Location of the day's exit interview
# of Counts	Number of counts that took place that day
Fishing Activity on River	1 = fishing activity occurred on the river that day; 0 = no fishing activity occurred on the river that day
Location(s) of Fishing Activity	Numbers corresponding to each of the 8 river locations [1 = Northern Boundary of Study Area; 2 = Riverbank Park-Kearny (RBP-Kearny); 3 = Pathmark Grocery Store; 4 = Hess Gas Station; 5 = Heliport; 6 = Riverbank Park-Ironbound; 7 = I-95 Bridge; 8 = Southern Boundary of Study Area]; X-Y indicates fishing activity between locations X and Y [e.g., 1-2 indicates fishing activity between locations 1 and 2]
Max Individual Angler Count	Maximum number of anglers counted on the river during any one counting run
Total # of Angler Obs.	Total number of angler observations counted on the river over the course of an entire 8 hour shift
# of Anglers Intercepted	Total number of anglers intercepted during an exit-interview shift
# Completed Interviews	Total number of exit interviews completed during an exit-interview shift
# Missed Reports	Total number of completed missed-creel reports (this column + # Completed Interviews = # of Anglers Intercepted)
# of Anglers Catching Fish	Total number of exit-interview anglers who catch fish
# of Anglers Keeping Fish	Total number of exit-interview anglers who keep fish

THE CREEL/ANGLER SURVEY

WORK PLAN

FOR

THE PASSAIC RIVER STUDY AREA

October 23, 2000

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

CAS	creel/angler survey
CASWP	creel/angler survey work plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CLH	Chemical Land Holdings, Inc.
DQO	Data Quality Objective
ESP	Ecological Sampling Plan
HASP	Health and Safety Plan
HASPA	Health and Safety Plan Addendum
HERA	Human and Ecological Risk Assessment
MSE	mean square error
NMFS	National Marine Fisheries Service
PDF	probability distribution function
PPE	personal protective equipment
PPS	probability proportional to size
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
RI/FS	remedial investigation and feasibility study
USEPA	United States Environmental Protection Agency

1.1 BACKGROUND

This revised Creel/Angler Survey Work Plan (CASWP) has been prepared by Chemical Land Holdings, Inc. (CLH) in accordance with the specifications for the conduct of a Creel/Angler Survey (CAS) that are contained in the Ecological Sampling Plan (ESP) for the Passaic River Study Area (Study Area), and in consideration of U.S. Environmental Protection Agency (USEPA) comments on the CAS Scope of Work received on April 15, 1996; CASWP received, informally, January 2000, and as a result of the meeting between CLH, USEPA, and the New Jersey Department of Environmental Protection on May 23, 2000. Specifically, this revised CASWP contains the protocols for implementing on-site counts and exit interviews of recreational anglers that may catch and consume fish and/or crab from the Study Area.[1] In addition, this revised version of the CASWP is based on extensive pretesting of earlier survey instruments and protocols (conducted in accordance with previous versions of this CASWP).

The ESP was developed and is being implemented in accordance with Section B.3.a.ii.(1) of Paragraph 39.b and Appendix I (Statement of Work) of the Administrative Order on Consent (AOC), dated April 20th, 1994, between USEPA and Occidental Chemical Corporation. Specifically, USEPA made the determination, after review of the Draft Screening-Level Human Health and Ecological Risk Assessment (Draft Screening-Level HERA) for the Study Area (submitted to USEPA on July 6, 1995), that insufficient information was available to complete the HERA. The ESP (including the conduct of a CAS) was prepared by CLH, and approved by USEPA on April 6, 1999. The purpose of the work being conducted under the ESP is to collect data to be used in conjunction with

[1] In this document "anglers" refers to people who participate in fishing and/or crabbing in the Study Area.

historical data and data collected under the Remedial Investigation and Feasibility Study (RI/FS) Work Plan, to complete the HERA, and in support of the FS for the Study Area.

This CASWP contains six sections and eight appendices. This section (Introduction) provides the objectives for the CAS, as well as a detailed review of other angler studies that have been performed in the geographic region surrounding the Study Area. Section 2 presents the Data Quality Objectives (DQOs) for the CAS. Section 3 contains the detailed scope of work for the On-Site Survey. Section 4 describes the sampling procedures used for the On-Site Survey. Section 5 describes The Data Management and Analysis Plan. References are provided in Section 6.

The quality assurance and quality control (QA/QC) procedures for implementation of the CAS are provided in Appendix A (Quality Assurance Project Plan). The Angler/Crabber Counts Form is presented in Appendix B. The Interview Form is provided in Appendix C (in English, Spanish, and Portuguese). The Missed Creel Form is provided in Appendix D. A sampling simulation model that was constructed to assist in the design of the on-site survey-sampling plan is presented in Appendix E. The August-October Count and Interview Schedules are provided in Appendix F. Finally, an addendum to the Study Area Health and Safety Plan (HASP) that is focused on the CAS field activities is provided in Appendix G.

1.2 Study Area Setting

The Study Area is located on the lower portion of the Passaic River, one of the tributaries to Newark Bay, in the Greater New York City Metropolitan Area (Figure 1-1). The Study Area is defined as that portion of the Passaic River extending from the abandoned ConRail Bridge (located approximately 4,000 feet upriver from the red channel junction marker at the confluence of the Hackensack and Passaic Rivers with Newark Bay) to a transect six miles (31,680 feet) upriver of this bridge.

Figure 1-1: Study Area Location

Industrial activity and discharges from combined sewer outfalls, storm sewers, and nonpoint-source urban runoff along the river have resulted in a variety of environmental contaminants in the Study Area. In addition, the river within the Study Area contains a substantial amount of floatable debris that moves up and down the river with the tide. The quantity of these floatables, in addition to the heavy industrialization of the river within the Study Area, appears to limit boating activity. Within the past 10 years, CLH's representatives (primarily scientists and engineers who have performed numerous studies on the river at various times of the day and year) have observed only very minimal boating activity in the Study Area. Therefore, boat-based angling is not expected to be a key component of this CAS.

The shorelines of the Passaic River within the Study Area consist primarily of private industrial and urbanized properties. For this reason, most of the Study Area is not accessible to recreational anglers who fish from shore. Public access areas are extremely limited. There is only one public boat ramp (located in Kearny near the upstream boundary of the Study Area) within the Study Area. Because the Study Area is part of the tidal portion of the Newark Bay Estuary, recreational anglers are not required to have licenses to fish or crab. Determining the amount of shoreline angling that takes place in the Study Area on a seasonal basis is a key goal of this CAS.

The lower Passaic River supports only a limited fishery, as evidenced by recent fish community surveys conducted in the late summer and early fall of 1999, and in the spring of 2000. The relative diversity and abundance of species, including those of recreational interest, appear low compared to results from studies of other waterways within the NY/NJ Harbor Estuary. Table 1-1 presents a list of the species captured during the ESP surveys, and a perspective of their likely seasonal use of the Study Area, based on life history characteristics and regional fisheries information.

Table 1-1: List of Fish and Crab Species and Their Expected Seasonal Availability in the Passaic River Study Area[2]

Species	Scientific Name	Spring	Summer	Fall	Winter
Atlantic menhaden	*Brevoortia tyrannus*	✓	✓	✓	
Blue crab	*Calinectes sapidus*	✓	✓	✓	
Blueback herring	*Alosa aestivalis*	✓			
Bluefish	*Pomatomus saltatrix*		✓	✓	
Brown bullhead	*Ameiurus nebulosus*	✓	✓	✓	✓
Carp	*Cyprinus carpio*	✓	✓	✓	✓
Channel catfish	*Ictaluris punctatus*	✓	✓	✓	✓
Eel	*Anguilla rostrata*	✓	✓		
Gizzard shad	*Dorosoma cepedianum*	✓	✓	✓	✓
Mummichog	*Fundulus heteroclitus*	✓	✓	✓	✓
Striped bass	*Morone saxatilis*	✓	✓	✓	
Weakfish	*Cynoscion regalis*	✓	✓	✓	
White catfish	*Ameiurus catus*	✓	✓	✓	✓
White perch	*Morone americana*	✓	✓	✓	✓
White sucker	*Catastomis commersoni*	✓	✓	✓	✓

1.3 Objectives and Risk Assessment Context for the Creel/Angler Survey

The key objective of the CAS is to collect data that will be used to quantify the exposure factors required to assess human health risks from consumption of fish and/or crab from the Study Area. These data (as summarized in Table 1-2) are required because representative data and information are not currently available to perform an accurate site-specific assessment of human health risks from fish and crab consumption. A detailed discussion of the data and information to be collected under this CAS is provided below.

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[2] Based on data collected during the implementation of the ESP in late summer/early fall 1999, and Spring 2000.

Table 1-2: Creel/Angler Survey Data Collection Summary

Step 1: Site-Specific Exposure Factor and Risk Characterization Terms	Step 2: Empirical Measures	Step 3: Survey Questions
1. Quantitative Terms		
Number of trips	Fishing trips per year to Study Area	No. of trips in the previous month, demographics, season, presence of target species, day of week/holiday, weather
Consumption rate	Grams/trip of Study Area fish or crabs eaten by species and part of fish or crab.	Average catch and keep rate, average size (by species), number of fish/crabs kept by species, size of fish/crabs kept to eat, number of people sharing the fish/crabs, parts of fish eaten, demographics, season
Exposure duration	Number of years the individual will fish in the Study Area	No. of years since the individual first fished the Study Area, proportion of years fished in the Study Area in the last five years
Concentration	Concentration of constituents by species and part of fish	Parts of fish eaten, cooking methods
2. Qualitative Terms		
Demographics	Age, education, ethnicity, income	Age, education, ethnicity, income
Subpopulations	Demographics, consumption, whether children, pregnant women, or nursing mothers share catch	Demographics, consumption, whether children, pregnant women, or nursing mothers share catch

Based on a review of the limited creel/angler intercept studies that have been conducted to date in the vicinity of the Study Area, data are not available on the specific parameters that are necessary to complete a fish/crab consumption risk assessment for the Study Area. A summary of this review is provided in Section 1.4.

The data from the CAS will be used for three key purposes in the risk assessment: 1) to identify and characterize populations, including any subpopulations, that may be exposed to chemicals in fish or crab from the Study Area, 2) to quantify key exposure factors necessary for the human health risk assessment and, 3) to quantify the size of the exposed populations. Following is a summary of how the CAS information will be used in the risk assessment.

1.3.1 Evaluation of Exposed Populations

The CAS data will allow multiple exposed populations, including those that are potentially experiencing higher exposure than others, to be identified and subsequently evaluated in the risk assessment (e.g., on-site anglers, children, pregnant or nursing women, nursing infants). *Sociodemographic Data Used for Identifying Potentially Highly Exposed Populations* (USEPA, 1999a) recommends that "assessors are encouraged to collect site-specific data to help confirm if any groups are experiencing high exposures." Specifically, there is a greater probability that the on-site survey will capture information on subsistence anglers than on infrequent anglers. This is due to the concept of avidity bias (i.e., bias towards frequent anglers). For example, an angler who fishes once per year during a one-year survey has a 1/365 chance on any given day of the survey of being surveyed. However, an angler who fishes once per week has a 52/365 chance on any given day of the survey of being surveyed. Therefore, the angler who fishes more often has a greater chance of being interviewed during the survey period. The avidity bias concept is recognized by USEPA (1997), statistical literature as early as the 1960s (e.g., Robson, 1961), and fisheries management literature (e.g., Pollock et al., 1994). In addition, avidity bias correction has been used in on-going fisheries research conducted by the National Marine Fisheries Service (NMFS) (NMFS, 2000) since the early 1980s, including the NMFS studies relied upon by the USEPA in *Exposure Factors Handbook* (USEPA, 1997) for marine recreational anglers.

Information from the survey will be used to determine whether potentially sensitive or subsistence subpopulations use the Study Area. USEPA guidance recommends that any population of anglers that demonstrates fish or crab consumption habits that are different from those of the general angler population, and that is distinguishable from the general angler population according to demographic criteria (e.g., ethnicity, income), should be considered separately in a risk assessment (see, e.g., USEPA, 1989; 1999a,b). An on-site intercept survey is the most appropriate method for collecting data to determine whether subpopulations exist (see USEPA, 1992; 1998). The determination of the existence of

subpopulations will be completed during data analysis in the risk assessment, using primarily data from the CAS supplemented with information from the U.S. Census and published information regarding fishing practices near the Study Area.

In practice, the primary concern of risk assessors is so-called "subsistence" subpopulations. Subsistence subpopulations are defined as groups of anglers who depend on fishing and/or crabbing to provide a consistent source of food. This theoretical dependence on fishing and/or crabbing for food leads to the expectation that subsistence anglers would have fish or crab consumption rates exceeding those of anglers whose interest in fishing and/or crabbing is recreational. Because the dependence on angling for food is assumed to be either economically or culturally motivated, income or ethnicity characteristics of anglers are used to identify potential subsistence subpopulations. Specifically, the information obtained from the on-site survey will be examined using the following two approaches: 1) those anglers whose consumption rates fall in the upper percentiles would be identified and their data analyzed to determine whether they share a common trait (e.g., ethnicity, income), and 2) those anglers who shared a common trait would be identified and their data analyzed to determine whether their fish consumption rates differ statistically from those of the general angler population.

Potentially sensitive subpopulations include children and pregnant or nursing mothers with whom the angler shares their catch. Developmental effects in these subpopulations due to exposure to chemicals via consumption of fish or crab from the Study Area may be a concern. The on-site survey will collect specific information on the existence of exposure factors for subpopulations via interviews with anglers.

1.3.2 Exposure Assessment

The CAS data will be used to support an accurate exposure assessment. The goal is to use the data to support a site-specific event-by-event exposure assessment (i.e.,

fishing/crabbing trip by fishing/crabbing trip), although the data will also support a site-specific point estimate risk assessment.

For an event-by-event exposure assessment, data collected during the survey will be used to calculate site-specific probabilities and distributions. Briefly, hypothetical anglers will be simulated through their fishing/crabbing careers based on data collected during the CAS. The analysis will begin by assigning an angler's personal characteristics (gender, age he/she began fishing/crabbing, duration of fishing/crabbing career [exposure duration]). In addition, the angler will be assigned his/her preferences (e.g., fish/crab species that would be consumed if caught and the cooking methods used for preparing the consumed species).

Information for the angler's first trip (i.e., the seasons fished and the number of trips the angler would take per season) will be assigned, and then the analysis will simulate the angler's first trip of the first season of the first year that he/she fishes and/or crabs. For the trip, the analysis will use probabilities calculated using information from the CAS to model whether the angler catches any fish or crab. If no fish or crab are caught, the trip ends and the analysis simulates subsequent trips. If fish or crab are caught, the combination of fish and/or crab that are caught is decided. Based on the angler's assigned preferences, the decision is made as to whether or not the angler consumes the species of fish and/or crab caught. If the angler consumes the fish and/or crab, then a consumption rate (g/trip), the cooking loss associated with the angler's preferred cooking method, and the chemical concentration in the fish/crab for each species consumed is used to calculate the uptake of the chemical from this trip.

The analysis will continue to simulate the remaining trips of the month, then of the remaining months of the year, and then the remaining years of the angler's fishing/crabbing career, updating the angler's age and body weight accordingly. The analysis then simulates additional anglers using the same method. This technique has

proven useful at other sites (e.g., the Palos Verdes Shelf, CA) where the exposure assessment results were validated by independent data (Wilson et al., in press).

This event-by-event analysis approach, which is similar to that used at other Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, including the Hudson River (TAMS Consultants, Inc., and Gradient Corporation, 1999), eliminates the unrealistic overestimates common with extrapolating short-term data to represent long-term exposure. Specifically, the analysis will incorporate fish consumption rate data collected by the CAS in the units directly measured during the survey (g/trip). Therefore, there is no need to extrapolate information from the survey to the traditional units of g/day and then have to assume that the same consumption rate is applied for the entire static exposure duration. This event-by-event analysis will estimate exposure via a realistic multi-species diet with varying species amounts for each person, versus the typical artificial unchanging diet for everyone upon which most risk assessments are based.

Risk assessment exposure factors for the fish and shellfish consumption pathway are defined in the following standard equation, which is used to estimate chemical intake:

$$\text{Intake(mg/kg-day)} = [C \times FR \times CR \times TF \times ED] / [BW \times AT],$$

where:

C = chemical concentration in fish or crab (in parts consumed) (mg/kg);
FR = fraction of chemicals remaining after cooking (mg/mg);
CR = rate of consumption of fish or crab (of parts consumed) (kg/trip);
TF = trips to the Study Area (trips/year);
ED = exposure duration (years);
BW = body weight (kg); and
AT = averaging time (days).

The specific methodology adopted for the risk assessment defines the level of detail required for each term in this equation. For example, adopting an event-by-event methodology allows for incorporation of the effects of seasonal changes on exposure factors such as number of trips to the Study Area, species-specific consumption rates, annual changes in body weight, and chemical concentrations in fish and crab. The use of the CAS data to quantify each of these terms is discussed in the subsections below.

1.3.2.1 Trips

Exposure to chemicals in fish or crabs or both results from consuming fish or crabs or both harvested on fishing, crabbing, or fishing and crabbing "trips" to the Study Area. A trip is distinguished from actual consumption of fish or crabs, which may or may not result from any given trip. However, measuring exposure in reference to trips does not limit consumption to either the day of the trip or the person taking the trip. Rather, the trip is the natural and most accurate basis for quantifying exposure because consumption of Study Area fish or crabs requires a trip, and the outcome of a trip can be directly observed.

For an angler, the number of trips per unit of time may vary across years as well as across periods (e.g., seasons) within a year because of factors such as weather and the presence of species targeted by the individual. The number of trips per period also may vary with daily weather within a season, with days of the week/holidays, and with tidal patterns. Trips may also vary across individuals in a manner related to distance from the Study Area, ethnicity, income, age, and sex.

The individual rate of trip-taking will be determined on the basis of survey data on the number of trips taken to the Study Area in the past month (for example, if the angler is interviewed in September, the interviewer will ask how many trips the angler took to the Study Area in August). The months of the year in which the individual makes trips to the

Study Area will also be determined. This information will be collected separately for fishing and crabbing.

1.3.2.2 Consumption Rate

Consumption rate is defined as grams eaten per trip by an individual by species and by part of the fish and of the crab. Consumption will be quantified from information on catch and keep rates by species, trip duration, size of fish or crab, whether the fish or crab is eaten, the parts of the fish or crab eaten, and the fraction of the fish or crab part eaten.

The catch and keep rate by species and size may vary by season or location and perhaps also by factors that vary by individual anglers, such as fishing experience (i.e., the number of years fished) or demographic characteristics. Trip duration may vary by factors affecting trip frequency.

The fraction of the fish or crab part eaten by an individual will be obtained both by using a portion-size approach model for several portion sizes and by determining the fractions of caught fish or crab eaten by all those sharing the fish or crab. Fish and crab from the anglers' creel will be measured if the angler allows it.

1.3.2.3 Exposure Duration

Exposure duration is defined as the number of years an angler fishes or crabs in the Study Area. The anglers will be asked the number of years he/she has fished or crabbed or done both in the Study Area. The proportion of years fished or crabbed within that period is determined by asking the respondent which years he or she fished and/or crabbed in the Study Area in the last five years. The CAS data will be used to estimate total exposure duration (i.e., reported number of years plus estimated future number of years using standard methods from the literature [see, e.g., Price et al., 1998]). Exposure duration for those with whom the angler shares his or her catch will be determined in reference to the angler's exposure duration.

1.3.2.4 Averaging Time

This exposure factor is a standard value (70 years) if the effect of exposure is carcinogenic. If the effect of exposure is noncarcinogenic, then this variable is equal to exposure duration and will be determined from information obtained in the CAS.

1.3.2.5 Parts Eaten and Cooking Methods

It is important to collect information on parts of fish and crab eaten by anglers and those with whom they share their catch, because different parts may contain different concentrations of chemicals (e.g., the crab hepatopancreas versus the meat). Similarly, as detailed in the literature (see, e.g., Wilson et al., 1998) many cooking methods used to prepare fish and crabs may reduce the amount of chemicals in the consumed portion as compared to when raw fish or crab tissue is consumed. For this reason it is important to collect information on cooking methods used by people who harvest fish and/or crabs from the Study Area.

1.3.3 Risk Perspectives Using the CAS Data

The CAS data will be used to place estimated risks into perspective with respect to the size of the populations that may be at risk. Proper estimates of population sizes will be calculated from the survey data. To help develop these estimates, USEPA encourages the use of site-specific surveys for enumeration of populations with high-risk behavior patterns, such as subsistence anglers (USEPA, 1999a).

These variables are related to determining whether subpopulations are present which should be treated separately in the risk assessment and to the qualitative aspects of risk characterization. To identify potential subpopulations, the on-site survey will collect demographic information from respondents, including age, education, ethnicity, gender, and income.

Finally, counts of anglers made throughout the survey will be scaled up to estimate the size of the angler population using standard methods from the literature (see, e.g., Lester et al., 1991). Estimates of the number of non-angler consumers of Study Area fish and crab will also be based on CAS data. U.S. census data will be used to understand how the demographic characteristics of Study Area anglers compare with those of nearby residents.

1.4 Review of Angler Survey Studies in the Newark Bay Estuary

In the most comprehensive angler survey conducted in the Newark Bay Estuary to date, Kirk Pflugh et al. (1999) performed a creel/angler intercept survey to gain greater insight into the information sources and risk perception of urban anglers using the "Newark Bay Complex," which excluded the Study Area. The intercept survey was performed following implementation of various community outreach activities that were designed to discourage consumption among urban anglers.

The objectives of the Kirk Pflugh et al. (1999) study were to learn about anglers': 1) knowledge of fish/crab consumption advisories; 2) belief in advisories; 3) perception of how safe fish and crabs are to eat; 4) sources of information about fish and fishing and crab or crabbing; 5) sources of information on fish/crab consumption advisories; and 6) demographics. The plan was to use the results of the study to design an outreach program that incorporated the needs and concerns of urban anglers while addressing any misperceptions or lack of information regarding health and fish and crab consumption advisories.

The Kirk Pflugh et al. (1999) study completed interviews with 300 participants at 26 sites during 39 days in the field for about 2.5 months in the summer (i.e., from July to October 1995). The survey team attempted to conduct the surveys during high tide because the researchers surmised that this was when anglers were most likely to be fishing and crabbing. The surveys were conducted on both weekdays and weekends. The surveyors

interviewed similar numbers of fishermen and crabbers. Few people both fished and crabbed (i.e., 3% of participants).

Before the study, the researchers hypothesized that the typical urban angler in the Newark Bay Complex was male, retired, Hispanic, low income, using fish and crabs as major sources of protein (i.e., consuming them for subsistence), and lacking in knowledge of advisories and in understanding of health impacts. In reality, the study found that the typical angler was male, 30 to 39 years old (i.e., unlikely to be retired), white, a high school graduate, and earned the median annual income (i.e., $25,000 to $35,000).

In addition, the study found that women, Hispanics, lower-income (i.e., with an annual income less than $15,000), younger (i.e., less than 50 years old), and less-educated anglers were more likely to crab than to fish. The study also found that men, African-Americans, higher-income (i.e., those receiving more than $35,000), older (those more than 70 years old), and more educated (i.e., college-degree holding) were more likely to fish than to crab.

Most of the survey participants received their information on fish and crab consumption advisories from the newspaper and their information on fish and fishing or crabs and crabbing from other anglers or from bait and tackle shops. The Kirk Pflugh et al. (1999) study concluded that although most of the anglers interviewed had heard of the fish and crab consumption advisories, they could not state the advisories correctly, and they either did not believe or were unconcerned about health effects from eating contaminated fish or crabs. The evaluation of subsistence fishing is discussed in an article that accompanied the Kirk Pflugh et al. (1999) article (i.e., Burger et al., 1999).

Burger et al. (1999) evaluated the effect of ethnicity on the results of the Kirk Pflugh et al. (1999) study. This study found that 1) a higher percentage of Hispanics consumed blue crab (a species in area waterbodies for which a health advisory had been issued) if caught than did whites or blacks; 2) blacks and Hispanics generally felt that the fish or

crabs were safer to eat than did whites; 3) whites and blacks were more aware of the warnings and more likely to cite them correctly than were Hispanics; and, 4) whites thought the risks of developing cancer or harming unborn or young children from consuming locally caught fish or crabs during a lifetime were greater than other racial groups thought they were, Hispanics thought the risks were lower than whites or blacks thought they were, and blacks thought the risks were of intermediate severity between the risk assessments of whites and of Hispanics.

The Burger et al. (1999) study found that about half of the respondents thought it was safe to eat the fish or the crabs. Even after survey participants were told that an advisory existed, most still believed that eating the fish and crabs they caught was safe, and about 30 percent stated that they did not intend to follow the advisory recommendations. However, when the question was posed differently, 85 percent said they would stop eating locally caught fish if it increased their cancer risk, and even more said they would encourage women in their households to stop eating fish if it increased risk to an unborn child (96 percent) or to children after birth (97 percent).

In addition, the Burger et al. (1999) study attempted to evaluate the prevalence of subsistence angling on the basis of household income. However, the idea was abandoned once the median income of the participants (i.e., $25,000 to $35,000) was determined to be well above the poverty threshold for a family of four (i.e., $15,569). The study mentions but does not evaluate the 18 percent of participants who earned less than poverty level of income, and the authors noted that subsistence fishing and crabbing could be a concern for Hispanics (of whom 19 percent reported a household income of less than $10,000) in contrast with whites and blacks (of whom 11 percent reported a household income of less than $10,000). However, the researchers did not attempt to compare anglers' fish or crab consumption rates with their income level or ethnicity.

To summarize, although the Kirk Pflugh et al. (1999) and Burger et al. (1999) studies were conducted in the vicinity of the Study Area, they did not collect data from the Study

Area itself, nor information on fish/crab consumption rates, or other quantitative information necessary for risk assessment, or for accurately identifying subpopulations such as nursing mothers or subsistence anglers who may be exposed to fish or crabs from the Study Area or the surrounding environs.

In an earlier study, May and Burger (1996) performed a creel/angler intercept survey of anglers along the shore and on party boats at the Arthur Kill, Raritan Bay, and New Jersey shore. The survey examined the consumption habits of anglers at these sites, whether the anglers were aware of the fish consumption advisories, how the anglers perceived the risk of eating fish caught from the sites, whether the anglers were exposed to potentially harmful levels of toxic substances in fish, and whether their risk perceptions matched the severity of the hazard. The survey contained questions about how often the anglers fished in a month, how often they caught fish, how many they usually caught, how often they ate fish, if they ate their catch, how they cook the fish, and if they had a preference for smaller or larger fish. The anglers were also asked questions regarding advisory awareness and perceived risks, and some demographic information was collected.

The May and Burger (1996) survey did not have the right study design or instrument to accurately determine fish and crab consumption rates and other exposure factors for risk assessment. For instance, May and Burger (1996) calculated consumption rates on the basis of recall information regarding "usual" consumption and did not rely on measurement of creel-saved catch, the latter being a more accurate measure of consumption. In addition, questions were not included in the survey, nor was the survey of sufficient duration (i.e., seasonal and number of survey days/hours), to determine exposure duration. Thus, the information collected by the survey also does not allow for the evaluation of exposure factor relationships such as seasons and species availability, seasons and consumption behavior, or age and fishing behavior. Finally, May and Burger (1996) did not intercept anglers in the Passaic River Study Area.

May and Burger (1996) completed interviews with 318 participants in approximately 5 months (i.e., from May to September 1994). The study found that, on average, the anglers consumed fish from all sources 4.6 times per month and consumed an average serving size of 10.3 to 11.5 ounces. In addition, most of the anglers interviewed only ate fish fillets and either fried or broiled/grilled their fish. Information on crabbing was only collected from the Arthur Kill. On average, crabbers consumed crabs 3.7 times per month and consumed 9.5 crabs per meal (from all sources, including store-bought crabs, although most consumed mostly the crabs they caught themselves). In addition, most crabbers cleaned the crabs before eating them and boiled, fried, and/or steamed the crabs. The researchers acknowledged the effects of avidity bias on their results but did not correct their results for the bias.

A substantial portion of the anglers who were aware of the consumption advisories still consumed their catch. The researchers estimated that anglers from the Arthur Kill, in particular, are probably consuming fish and crabs in excess of the amounts recommended in area advisories. In addition, most of the survey participants believed the water and fish and crabs to be safe.

Although May and Burger (1996) collected limited fish and crab consumption information in their survey, the information collected is not sufficient or adequate to support a detailed (i.e., probabilistic or accurate point estimate) site-specific risk assessment for the Study Area. The waterbodies surveyed are very different than the Study Area, and the surveys were not conducted in a manner that provides sufficient or accurate data for the exposure factors of interest for the Study Area risk assessment.

In summary, CLH's review of angler studies conducted in the Newark Bay Estuary found that the studies were not designed or implemented to provide the detailed information necessary to complete a human health risk assessment of fish and crab consumption in the Study Area. This CASWP describes the approach and scope-of-work needed to conduct a survey of anglers specifically using the Study Area, and to collect the data needed to

define site-specific exposure values for use in the quantitative assessment of fish and crab ingestion pathways in the HERA. To the extent possible, the information presented in the studies summarized above were used to guide the development of the Study Area CAS. Specifically, information regarding ethnicity of anglers, survey success, survey response rates, and pre-test results were carefully considered in designing the survey instruments presented herein.

1.5 Overview of CAS

The CAS will collect data for a one-year period. This period was chosen as the minimum length of time needed to collect representative information on the basis of the expected variability of behavior resulting from, among other factors, the weather and the seasons of the year. Other angler surveys used for CERCLA risk assessments have used a one-year field sampling period (e.g., SCCWRP and MBC, 1994; Bales, 1993; SAIC, 1999, Bechtel, Inc., 1993, and Simon, 1999).

The on-site survey uses two data collection methods: boat-based counts of anglers in the Study Area (On-Site Counts) and land-based interviews of anglers at designated locations (On-Site Interviews). The boat-based counts are used to enumerate anglers using the Study Area. The land-based interviews are used to provide complete creel data on anglers' trips. Combining these data collection methods provides two complementary sources of angling information in the Study Area. The On-Site Counts from the boat-based team ensure that every angler on the river is enumerated and the On-Site Interviews provide the details regarding the fishing and crabbing trips (e.g., number of trips taken to the Study Area, fish/crabs caught and eaten, and angler demographics).

The survey design is based on pretests of draft questionnaires, boat and land reconnaissance of the Study Area, and on-site questionnaire pretests. The survey instruments and protocols described in the CASWP were extensively pretested with residents of the local communities at a market research pretest facility, community-

outreach facilities, and on the Hackensack and Passaic Rivers. Each survey instrument and protocol was refined as a result of the pretests in order to maximize the likelihood of survey success and the accuracy and usefulness of the data collected from the survey. The survey instruments and protocols provide a data collection process that meets the objectives described in Section 1.3 of this CASWP.

2.0 DATA QUALITY OBJECTIVES

2.1 OVERVIEW

This section of the CASWP provides the DQOs for the CAS. The DQOs were developed in accordance with USEPA's *Guidance for the Data Quality Objectives Process* (1994). As such, the development of specific DQOs for this CAS are based on the defined uses of the data being collected. As described in detail in Section 1.3, this CAS has been designed to collect (via statistical survey methods) the appropriate site-specific data and information required to conduct a human health risk assessment, in accordance with USEPA guidance (1989).

The DQOs help define the appropriate data collection procedures that will ensure that high-quality data are collected. Meeting the DQOs will ensure that sufficient site-specific information can be collected from the CAS to meet the data needs for the risk assessment.

2.2 DATA QUALITY ISSUES AND OBJECTIVES

The quality of the data collected by the CAS depends on three key issues. First is the extent to which the survey questions and the respondents' understanding of them correspond to the conceptual variables to be measured. This issue is addressed through survey instrument design. Second is the extent to which a sufficiently high proportion of potentially exposed individuals will be contacted by the survey team so that these data will be, as determined by professional judgment, sufficient for conducting the risk assessment. This is a survey and sampling design issue. Third is the quality of the data that is collected and reported. This is a field implementation and data verification issue.

Separate DQOs are specified for 1) survey instrument design, 2) sampling design, 3) survey field implementation and, 4) data verification and handling. The extent to which

the DQOs are met is dependent on two key factors: the survey team adhering to specified procedures that minimize sources of error in implementing the survey, and sufficient sampling of places and times within the Study Area to obtain an adequate sample size, as defined by the proportion of Study Area anglers interviewed. In short, the DQOs are designed to minimize sampling and measurement errors.

The steps of the DQO process that are related to survey and instrument design have been completed as part of the development of this CASWP. The Quality Assurance Project Plan (QAPP) (Appendix A) specifies procedures for meeting the DQOs associated with implementation of the CAS.

2.2.1 Survey Instrument Design

The survey instrument design for the on-site survey is optimized by adhering to the following principles:

- The variables being measured by responses to the survey questions must meet the needs of the risk assessment.
- The empirical measures of the variables can be used to generate the site-specific exposure factors for the risk assessment.
- Each of the survey questions, if understood and truthfully answered by respondents, provides useful data for the risk assessment.
- The survey contains a logical set and phrasing of questions such that respondents understand it, cooperate with the interviewer, and provide accurate responses to survey questions.
- The survey is translated accurately into the languages spoken by respondents.

The three survey instrument design DQOs are:

DQO 1: No information gaps or limitations exist that will limit the ability to quantify the exposure factors necessary to conduct the risk assessment.

This DQO was met during the development of the CASWP. A multidisciplinary technical team was used to develop the CASWP and will be maintained to oversee the implementation of the CAS. This team includes experts in the field of risk assessment, statistics, fisheries biology, and public survey design and administration.

DQO 2: Minimize the number of potential respondents who refuse to be interviewed, and minimize non-responsive answers to survey questions by those who are interviewed, regardless of language spoken by or cultural sensitivities of the potential or actual respondent.

In order to meet this DQO, the survey design team pretested the survey to obtain feedback regarding: 1) how well the structure and content of the survey provides incentives to cooperate, 2) how well respondents understand the questions, and 3) whether questions were offensive to respondents based on cultural sensitivities. The pre-test helped determine the combination of questions, wording, and order that best allows respondents to understand and respond to the questions. In addition, interviewers are provided with a written set of responses for respondent questions. The QAPP (Appendix A), Section 3 provide more detail on pre-testing and survey implementation procedures.

The survey teams for the On-Site Interview will include individuals who are fluent in English, Spanish, and/or Portuguese. Based on U.S. Census data, the vast majority of encountered anglers should speak at least one of these languages. Respondents who prefer to communicate in these languages will be interviewed in their preferred language with the interviewer using survey instruments that have been translated into that language. After the final English version of the survey instrument was prepared, a

forward and backward translation was prepared for Spanish and Portuguese. The clarity, accuracy, and cultural appropriateness of the translations were assessed during the one-on-one component of the pre-test program, and changes were made as required. For other languages, the interviewer will first gain the cooperation of the respondent by handing him or her a card with an introduction written in the respondent's native language. If the respondent agrees to be interviewed, the second step will involve the use of cellular telephones with real-time translation. This method was pretested on August 4. Additional details on this approach are provided in Section 3 and the QAPP (Appendix A).

2.2.2 Sampling Design

The design for the on-site survey involves components relating to the sample population and to the sample size.

DQO 3: Specify the appropriate population for determining the fish and crab ingestion exposure pathways of the risk assessment and develop a sampling plan to target that population.

The populations of concern are anglers who use the Study Area and those with whom they share their catch. According to USEPA guidance (1992; 1998), an on-site intercept survey is the appropriate means to study angler populations in a specific waterbody or portion of a waterbody such as the Study Area.

DQO 4: Ensure that an appropriate amount of sampling effort is applied in the Study Area, and allocate this effort efficiently to support the collection of adequate data for the risk assessment.

The statistical sampling design of this CAS ensures that enough site-specific data will be collected to support the risk assessment by taking the following steps:

1. Sampling procedures were designed to capture a high proportion of anglers in the Study Area.

2. The sampling design was optimized so that step 1 is accomplished using a sound, cost-effective approach.

Guidance for the Data Quality Objectives Process (USEPA, 1994) specifies sample size determinations in terms of a known population size. The underlying population of interest, those individuals who use the Study Area to harvest and consume fish and crabs (and correspondingly those with whom they share their catch), cannot be accurately enumerated in advance. Therefore, the quantity of data to be collected is stated in terms of a *proportion* of Study Area anglers instead of as a minimum *number* of affected Study Area anglers. By using a repeated-sampling framework, very good estimates of population parameters can be obtained from small samples of individuals when sampling small populations (USEPA, 1998; Malvestuto, 1996; Robson, 1960; 1961).

Moreover, because the number of fishing days in the year is known (i.e., 365), and the potential fishing locations (areas of access to the bank of the river in the Study Area) are limited within the geographic confines of the Study Area, the focus of the on-site survey involves temporal and geographic sampling within the Study Area. This CAS has been practically and statistically designed to obtain accurate data from a one-year survey within the Study Area, in accordance with USEPA guidance (1992; 1998).

Quality data can be obtained from the CAS by efficiently allocating enough survey effort to a sample of the complete set of dates and times available for interviewing in the Study Area. The sampling design to meet this DQO was selected by 1) reviewing literature on creel surveys to determine to what extent good estimates of catch and effort can be obtained by using alternative sample designs and sample sizes, 2) designing and interpreting simulation experiments to empirically examine alternative designs (Appendix

E), and 3) using experience within the Study Area and practical considerations to formulate an implementable design.

2.2.3 Survey Implementation

The DQO for the survey (field) implementation relates to establishing the appropriate quality assurance and quality control procedures for implementing the survey.

DQO 5: Establish quality control and quality assurance procedures on the basis of standard practice for implementing the CAS.

The QAPP (Appendix A) specifies in detail how to implement the DQO process to meet this objective. The process includes using experienced interviewers and comprehensive interviewer training in administration of the survey instruments, methods for gaining cooperation from respondents, and use of translation services. A field supervisor will be responsible for monitoring the performance of the interview teams.

2.2.4 Data Verification

Data verification ensures that the specified procedures for data collection were followed and that there are no errors in the data. Data handling involves chain-of-custody issues, data coding and entry procedures, storing and backing up the data, and delivering the data in a form useable for analysis.

DQO 6: Establish quality control and quality assurance procedures for data verification and handling.

Section 5 and the QAPP specify in detail how to implement the DQO process to meet this objective. Procedures include checking on-site survey forms for completeness and consistency of responses and checking that sources of potential confusion are eliminated

before data entry and processing. As is standard and customary in similar surveys, double-key entry and verification will be used to ensure that data are accurately transferred from the survey forms into a computerized database.

3.0 ON-SITE SURVEY

The CAS was developed to meet the DQOs defined in Section 2. First, the risk assessment objectives and data needs, and statistical design and data analysis issues were considered. Subsequently, existing reports and information, as well as experts' opinions regarding other creel and angler studies that have been conducted were compiled and reviewed. From this information, a preliminary sampling approach was selected and evaluated for its appropriateness for the Study Area. The final sampling approach was selected following careful consideration of site-specific sources of data and information, including:

- the results of a sampling simulation model (described in detail in Section 4)
- site visits
- logistical considerations
- survey pre-testing with residents of the local communities.

Based on the results of the pre-test, the use of two data collection methods was selected as the most appropriate design for this CAS. The two methods include On-Site Counts and On-Site Interviews. Section 3.1 describes the On-Site Counts portion of the data collection. Section 3.2 describes the On-Site Interviews portion of the data collection.

The On-Site Counts involve water-based counts of anglers throughout the entire Study Area. The On-Site Interviews involve land-based interviews at randomly selected public access points in the Study Area. Combining these two data collection methods provides the most robust dataset for the Study Area because of the following logistical characteristics:

1. The Study Area contains a small number of specific, identifiable public-access

points for fishing/crabbing separated by substantial distances of commercial/industrial private property. Physical barriers (such as chain-link fences and razor wire) restrict access to the river from most of the private property.

2. The public-access fishing locations are spatially separated by substantial distances and are found on both sides of the Passaic River, which makes it logistically difficult to interview anglers at multiple access points on the same day by land. As noted later in this section, physical characteristics of the Study Area (e.g., wide mudflats at low tide) eliminated the option of approaching anglers by water and many pre-test participants opposed a water-based approach for interviewing.

3.1 On-Site Counts

One goal of the CAS is to obtain an accurate count of people fishing and/or crabbing in the Study Area. While a complete angler census would be obtained if the Study Area were covered by enumerators at all times of the day on every day for a year, such a census would be impractical and inefficient. Instead, a statistical sampling based on a stratified random sample will be used to accurately characterize angler use of the Study Area. As described by USEPA (1998; 1992), this is a standard approach to conducting creel/angler surveys.

The On-Site Count investigation was designed to obtain a robust dataset containing a substantial number of accurate angler counts in the Study Area during all seasons of the year. A boat-based team consisting of a driver and a counter will start from the northern boundary of the Study Area and will travel to the southern boundary of the Study Area, counting all the anglers on the river. Upon reaching the southern boundary, the team will turn around and return to the northern boundary, again counting all the anglers on the

river. This pattern will be repeated throughout the survey interval. The boat team will not stop to interview anglers; they will only count anglers.

The On-Site Counts will provide the basis for estimating the angler population using the Study Area. The On-Site Counts are designed to provide maximum enumeration of individuals fishing and/or crabbing along the banks of the Study Area. The On-Site Counts are an important aspect of the study design because they will provide complete documentation of fishing and crabbing activity over the entire Study Area during each sampling event. This is particularly important given the expected small total population of anglers using the Study Area.

3.1.1 Development of On-Site Counts

The implementation of the On-Site Count investigation is based on results from one-on-one pretests in the local community of survey questionnaires and boat reconnaissance of the Study Area. The On-Site Count approach was chosen because the majority of pretest respondents indicated that they would not want to be approached by boat. Respondent concerns about being approached by boat include:

- the boat would scare away the fish
- their fishing lines might get tangled in the propeller or other parts of the boat
- being approached by boat was potentially more intimidating than being approached by land
- participants did not want to be interrupted for an extended period while fishing and/or did not want to be interviewed more than once in the same day.

In addition to the pretest, boat reconnaissance was conducted on July 19, 26, and 27, 2000, to:

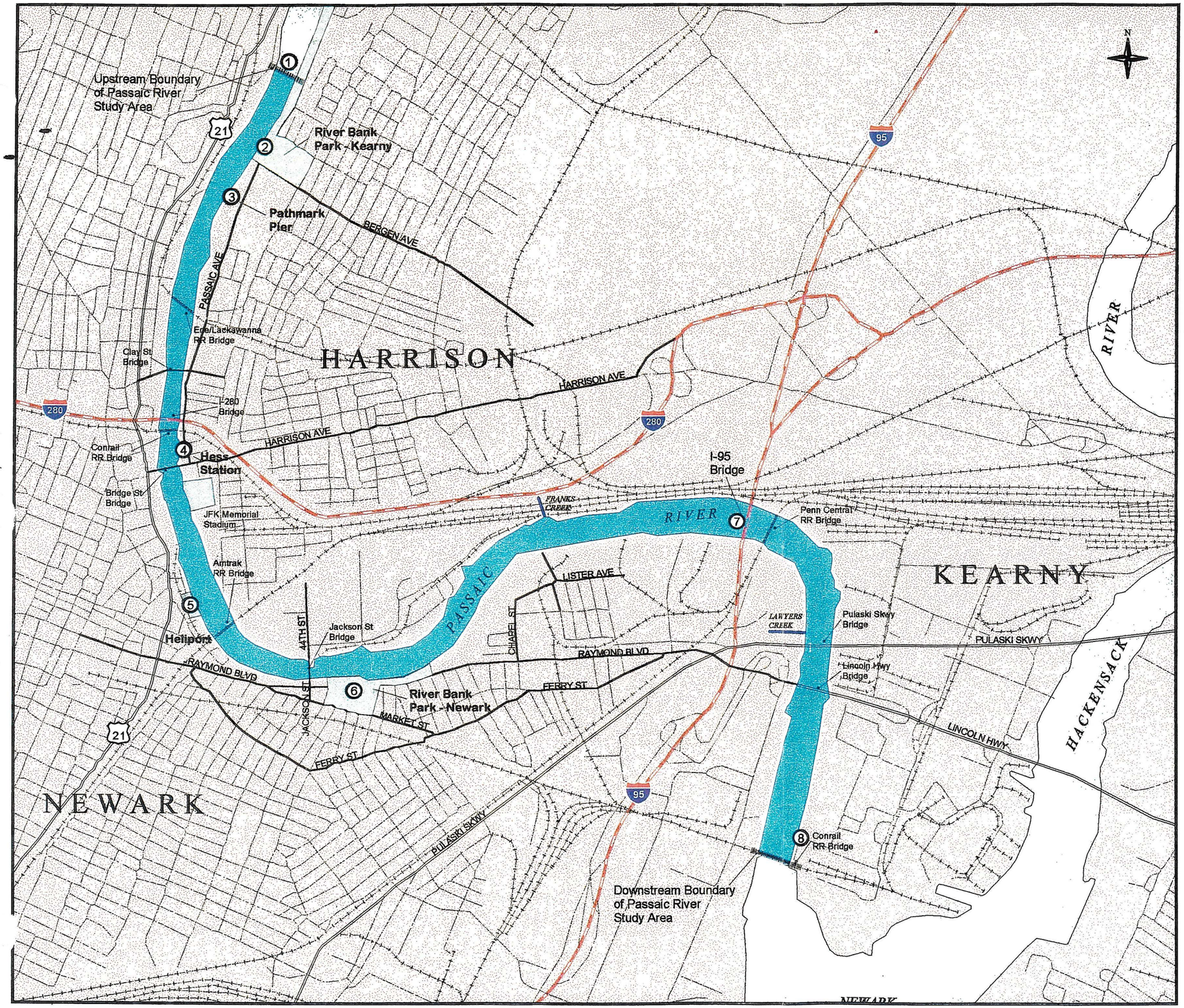
- investigate the feasibility of approaching anglers in the Study Area by boat
- check the location of access points
- test the form and protocols for counting anglers
- establish the time required to conduct the counts.

The boat reconnaissance revealed physical difficulties with coming ashore upstream or downstream from the anglers and trying to walk to them along the shoreline. For example, in many cases the bulkhead and shoreline at the interview locations and other points along the river do not allow safe landing from the boat onto the site. Fences, buildings, and private property typically flank interview sites and other locations both upstream and downstream of the sites. Moreover, mudflats also flank several of the interview sites at low tide, limiting shoreline access both upstream and downstream of the sites.

3.1.2 Count Form Design

Appendix B contains the Angler/Crabber Counts form that will be used by the boat-based count team to enumerate anglers using the Study Area. The Angler/Crabber Counts form is geographically based, following the count team's trips down and up the river. The Angler/Crabber Counts form focuses on eight distinct locations in the Study Area (see Figure 3-1). Five of the locations (Locations 2 through 6) were selected on the basis of field-reconnaissance findings and represent areas along the river with public access for angling. Locations 1 and 8 represent the upstream and downstream boundaries,

FIGURE 3-1.
PASSAIC RIVER STUDY AREA
CREEL/ANGLER SURVEY



LEGEND

- Study Area Boundary
- Primary Highway
- Secondary Highway
- Primary Street
- Secondary Street
- Railroads
- Creek
- Passaic River Study Area
- Water
- Park

Study Area Locations

1. Upstream Boundary
2. River Bank Park - Kearny
3. Pathmark Pier
4. Hess Station
5. Heliport
6. River Bank Park - Newark
7. I-95 Bridge
8. Downstream Boundary

0.25 0 0.25 0.5 0.75 1

Miles

1:24,000

Data Sources:
U.S.G.S. 1:24,000 Digital Line Graphs and Maps for Elizabeth, NJ 1981, Jersey City, NJ 1981, Orange, NJ 1981 and Weehawken, NJ-NY 1981.

respectively, of the Study Area. Listed by number, these locations are:

1. Upstream boundary of the Study Area,
2. Riverbank Park in Kearny,
3. Pathmark Bulkhead,
4. Hess gas station at Harrison Avenue in Kearny,
5. Heliport in Newark,
6. Riverbank Park in Newark,
7. I-95 bridge, and
8. Downstream boundary of the Study Area.

The counters will record the location, time, number of anglers fishing, number of anglers crabbing, and qualitative demographic information on each angler observed in the Study Area on each trip down or up the Passaic River. Counters also will mark the location of each angler on the Angler/Crabber Counts form map for those anglers not located at one of the eight predetermined locations.

3.1.3 Count Form Protocols and Instrument Overview

It will take approximately 30 to 45 minutes for the boat to travel the length of the Study Area going slowly enough not to miss any anglers. Therefore, one trip down the river (i.e., from the north end of the Study Area to the south end) will provide an instantaneous snapshot of the fishing/crabbing activity on the river. Returning to the north end of the Study Area will constitute a second instantaneous snapshot.

The counters will include everyone fishing/crabbing in the Study Area in their counts. If there are more people than fishing poles and crab lines at a particular location, then the

counters will count the poles/lines. Thus, people who are sitting or standing along the shoreline but not fishing/crabbing will not be counted. Alternatively, if there are more poles/lines than people at a particular location, then the counters will count the people. This counting protocol is most appropriate since the interviews are conducted with people who are fishing/crabbing or have one or more fish/crabs in their possession.

3.1.4 Angler/Crabber Counts Form

The data from the boat-based counts will be recorded on the Angler/Crabber Counts form (Appendix B), which details the presence or absence of fishing and/or crabbing along the river and demographic information for any angler observed fishing and/or crabbing. The counters will complete one Angler/Crabber Counts form for each run of the river. The counters will record their names, the date, the start location, and the time at the start of each run. The counters also will fill in the weather box for cloud cover, temperature, precipitation, and wind conditions at the start of the run.

One record on the Angler/Crabber Counts form contains *River Location, Riverbank, Time, # Fishing, # Crabbing, Type, Gender, Age, Race*, and five rows for angler demographic information. The counters will complete a record for each of the seven segments between the eight numbered locations on the map. If the run starts at Location 1, the counter designates Location 1 as the start location and records information for segments between Location 1 through 8. If the run starts at Location 8, the counter designates Location 8 as the start location and records information for segments between Locations 8 through 1.

The counters also will complete a record for each place where they observe at least one person fishing and/or crabbing between any two of the eight predetermined locations. If no fishing and/or crabbing activity is observed on a run, seven records will be completed, one for each of the segments between Locations 1 and 8. If fishing is observed between locations, for example, between Locations 4 and 5 and between Locations 1 and 2, then

nine records will be filled in. The nine records include one for each of the numbered locations and one for each of the two places where fishing/crabbing activity was observed between numbered locations (each Angler/Crabber Counts form can hold a maximum of nine records).

3.1.5 Locations

The map on the front of the Angler/Crabber Counts form shows the Passaic River from Location 1, the upper boundary of the Study Area near Smith's Boat Yard, through downtown Newark to the Jackson Street Bridge, the start of Location 6. The map on the back of the form shows the River from the Jackson Street Bridge to Location 8, the Conrail RR Bridge at the lower boundary of the Study Area. If the start location is 1, the counters will complete the front of the form first and then will complete the back of the form for the last few locations. If the start location is 8, the counters will complete the last record on the back of the form first. The counters then will work their way up the back of the form and then up the front of the form with each successive location. Following this protocol ensures that count records correspond with the maps on the front and back of the form. The boundaries of each of the eight numbered locations are described in Table 3-1.

3.1.6 River Location Data

For the eight numbered locations, the counters will complete a record for that location when they reach the end of the location. For example, Riverbank Park – Newark/Ironbound is a long, narrow park that runs along the Passaic River for at least one-half mile. The counters will complete the record for Location 6 when they reach the far end of the park. The end of the park will be downstream when doing a run from Location 1 to 8, and upstream when doing a run from Location 8 to 1. The counters will circle the location number under *River Location*. They then will Circle E or W under *Riverbank* for the east or west bank of the river (using the convention assuming the river

is always aligned north-south). Locations 2, 3, and 4, which are Riverbank Park in Kearny, the Pathmark store, and the Hess gas station, are on the river's east bank. Downtown Newark, the heliport, and Riverbank Park in Ironbound, are on the river's west bank. The counters will record the time when they reach the end of the location under *Time*.

Table 3-1: Boundaries of the Eight Numbered Locations

Location	Bank	Name	Upstream Boundary	Downstream Boundary
1		Building with HABA water tower near Smith's boat yard	End of Study Area	Building with HABA water tower
2	E	Riverbank Park—Kearny	Location 1	Fence before Rainbow Car Wash
3	E	Pathmark	Fence at Rainbow Car Wash	Fence at end of Pathmark parking lot
4	E	Hess Station	Fence at trash basket	Bridge Street Bridge
5	W	Heliport	Dock before heliport	AMTRAK Railroad Bridge
6	W	Riverbank Park—Ironbound/Newark	Jackson Street Bridge	Stacks of shipping containers
7		Interstate 95 Bridge	Interstate 95 Bridge	Interstate 95 Bridge
8		Conrail RR Bridge	Old broken RR bridge	End of Study Area

For places between two locations where counters observe fishing and/or crabbing, the counters will complete a record on the form when they pass the anglers. This puts that record between the records for the two numbered locations on either side. For *River Location*, the counters will circle the two location numbers that are on either side of the place where the person(s) is fishing and/or crabbing. For example, if a person is fishing from the Clay Street Bridge between Locations 3 and 4, the counters will circle both 3 and 4 under *River Location*. The counters will circle E or W under *Riverbank* for the side of the river where they observe the fishing and/or crabbing activity. They will record the time when they observe the individuals fishing and/or crabbing between locations under *Time*.

For observations of fishing and/or crabbing activity on any of the bridges that span the Passaic River, the counters will report the bridge name in the record near *River Location.* Bridge names are located on the Angler/Crabber Counts form map and on signs under the bridges.

3.1.7 Enumeration of Anglers

The counters will identify the number of persons fishing at the location and record that number under # *Fishing.* They also will identify the number of persons crabbing at the location and record that number under # *Crabbing.* A person is fishing if he or she has a pole in the water or is changing bait, reeling in a fish, or otherwise maintaining the fishing gear. A person is crabbing if he or she is setting or baiting a crab pot, holding a string in the water, or otherwise maintaining crabbing gear. If a person is fishing and crabbing, the counters will count him or her as fishing and will note in the demographic section that he or she is both fishing and crabbing. If no one is fishing and/or crabbing at a location, the counters will write "0" under # *Fishing* and # *Crabbing.*

3.1.8 Demographics

The final step to complete the record for a location is to provide the demographic characteristics for each person who is fishing and/or crabbing. The counters will complete one row in the record for each person who is observed to be fishing and/or crabbing at that location. There are five rows in a record. If there are more than five people fishing and/or crabbing at one location, the counters will complete the characteristics of the sixth person, seventh person, etc., in the next record. The counters will leave the left-hand side of this second record blank. This indicates that the demographic characteristics are for persons seen at the location recorded in the previous record.

For each person, the counters will record whether he or she is fishing, crabbing, or both fishing and crabbing. Under *Type*, the counters will circle F for fishing, C for crabbing, and both F and C if the person is both fishing and crabbing. The counters will determine the person's gender, circling F for female or M for male under *Gender*. They then will circle the appropriate age category under *Age*. Finally, the counters will record the individual's race by circling W for white or NW for non-white. If the person is non-white, the counters will try to determine the person's race and will write it in the blank next to NW in addition to circling NW. Several factors may make it difficult to determine some of the demographic characteristics for a person, including darkness and the person's clothing. If this is the case, the counters will use their best judgment for the person's demographics.

3.1.9 Marking Anglers on the Map

For each person fishing and/or crabbing between the eight locations, the counters will mark the map where they see the angler. The counters will mark each person who is fishing with an F and each person who is crabbing with a C on the map.

3.1.10 Coordination with the On-Site Interviews

For 100 of the 150 days in the sampling period, the On-Site Counts will be coupled with the On-Site Interviews. When interviews are being conducted on a sampled day, the counter will contact the interviewers during each run to tell them how many persons the counter observes fishing and/or crabbing at the interview location. The purpose of this contact is to ensure that the interviewers are aware of all persons fishing and/or crabbing at their interview location. Some locations are long or it is difficult to see the shoreline to determine from land alone whether any person is fishing and/or crabbing at that location. The counters' view of the location from the water will be invaluable to the interviewers.

3.2 On-Site Interviews

This section describes the design for the On-Site Interview portion of the CAS. The interview form used to collect the data is presented in Appendix C. For 100 of the 150 days that the boat-based counting team is on the river enumerating anglers in the Study Area, a land-based interview team consisting of two multi-lingual interviewers is stationed at one randomly selected interview location out of the five predetermined locations. The interview team stays at the interview site for the entire survey interval and interviews each angler at the site. The questionnaire used for the interviews was extensively pretested with residents of the local communities. The results of the pretests are summarized below.

3.2.1 Questionnaire Development and Pretest Results

The questionnaire presented in Appendix C was developed using two types of pretests: central location and on-site field pretests. Each is discussed in turn.

3.2.1.1 Central Location Pretest

The central location pretest involved recruiting participants to a central location (e.g., a marketing research firm or community center) and conducting one-on-one interviews to pretest and develop the On-Site Interview questionnaires. The interviews involved 36 participants recruited from the greater Newark, NJ, area. Northeast Data Corporation recruited the pretest participants. The pretests targeted four main groups potentially using the Passaic River as identified by U.S. Census data: Caucasian, African American, Spanish-speaking, and Portuguese-speaking anglers. Northeast Data Corporation specializes in recruiting and facilitating community interaction (e.g., focus groups and one-on-one pretests) with specific urban sub-populations.

As indicated in Table 3-1, the July 17 and 18 pretests involved Caucasian and African American participants recruited to Northeast Data Corporation's facility in Wayne, NJ.

Table 3-1:

Pretest Timeline and Description

Pretest Date	Pretest Type	Pretest Material	Location	Number of Participants	Participant Race	Pretest Language
July 17	One-on-one interviews	Exit-interview questionnaire	Northeast Data Corporation (Wayne, NJ)	10	Caucasian and African American	English
July 18	One-on-one interviews	Exit-interview questionnaire	Northeast Data Corporation (Wayne, NJ)	8	Caucasian and African American	English
July 19	Boat reconnaissance	Angler/Crabber Counts form and protocol	Passaic River Study Area	N/A	N/A	N/A
July 20	One-on-one interviews	Exit-interview questionnaire	La Casa De Don Pedro Community Center (Newark, NJ)	10	Hispanic	Spanish
July 21	One-on-one interviews	Exit-interview questionnaire	Ironbound Community Center (Newark, NJ)	8	Portuguese descent	Portuguese
July 22–23	Land reconnaissance	Exit-interview protocol	Passaic River Study Area	N/A	N/A	N/A
July 26	Land reconnaissance	Exit-interview protocol	Passaic River Study Area	N/A	N/A	N/A
July 27	Boat reconnaissance	Angler/Crabber Counts form and protocol	Passaic River Study Area	N/A	N/A	N/A
July 27	On-site, one-on-one interviews	Exit-interview questionnaire	Passaic River (north of Study Area) and Hackensack River	3	Caucasian and African American	English
August 2	On-site, one-on-one interviews	Exit-interview questionnaire	Passaic River (north of Study Area)	5	Caucasian and Hispanic	English
August 4	On-site, one-on-one interview	Exit-interview questionnaire	Passaic River (in Study Area)	1	Portuguese descent	Portuguese

These 18 pretest participants were recruited from the Newark, NJ, area using Northeast Data Corporation's database of Newark residents. Potential participants were screened for angling activity, gender, age, and race (i.e., recruiters were instructed to recruit a mix of Caucasian and African American male and female anglers over age 18).

The July 20 and 21 pretests involved Spanish- and Portuguese-speaking participants, respectively. The July 20 pretests were held at La Casa de Don Pedro Community Center in Newark, NJ. La Casa de Don Pedro Community Center is located off of Clay Street a few blocks from the Passaic River. The center specializes in community outreach to Newark's Hispanic population. The pretest participants were recruited using Northeast Data Corporation's database of Newark residents and contacts of La Casa de Don Pedro. Potential participants were screened for angling activity, gender, race, and language (i.e., recruiters were instructed to recruit a mix of Spanish-speaking male and female anglers over age 18). The pretests were administered in Spanish using a Spanish-speaking interviewer from La Casa de Don Pedro. The interviewer was trained on the questionnaire format and design and the study's objectives prior to conducting the pretests.

The July 21 pretests were held at the Ironbound Community Center Preschool in Newark, NJ. The Ironbound Community Center specializes in community outreach to residents of the Ironbound section of Newark, NJ. The Ironbound section is heavily populated with Portuguese-speaking residents, and the northern boundary of the community borders the Passaic River. The eight pretest participants were recruited using Northeast Data Corporation's database of Newark residents and contacts of the Ironbound Community Center. Potential respondents were screened for angling activity, gender, race, and language (i.e., recruiters were instructed to recruit a mix of Portuguese-speaking male and female anglers over age 18.) The pretests were administered in Portuguese using a Portuguese interviewer from the Ironbound Community Center. The interviewer was trained on the questionnaire format and design and the study's objectives prior to conducting the pretests.

In the pretests, interviewers administered a draft questionnaire to the participants. To simulate an actual on-site interview, interviewers provided the participants with a fishing rod and a stringer of artificial fish. Interviewers measured and photographed the artificial creel to simulate the mechanics of an actual interview. The artificial creel also provided context to each of the questions concerning fish preparation and consumption. After administering the questionnaire, the interviewers asked participants to describe any problems they had with the questionnaire including clarity of the translation and the meaning or tone of the questions. The interviewers also investigated the following specific issues:

- the participant's attitude toward being approached by interviewers on a boat
- desired forms of identification of interviewers
- reactions to being re-interviewed multiple times during the survey
- willingness to allow interviewers to measure and take a photograph of their catch
- willingness to provide their telephone number and name.

3.2.1.2 On-Site Pretest Interviews

On July 27, August 2, and August 4, interviewers conducted nine on-site pretest interviews with anglers on the Passaic and Hackensack Rivers. To avoid potentially influencing the Study Area fishing/crabbing population, the July 27 and August 2 Passaic River pretests were conducted upstream from the Study Area. Interviewers approached potential respondents, explained that they were conducting a fishing/crabbing survey, and administered the questionnaire. Following the interviews, the interviewers debriefed the anglers on their reaction to the questionnaire, comfort with the way they were approached, attitude toward being approached by boat, reaction to being interviewed

multiple times during the survey, willingness to allow interviewers to measure and take a photograph of their catch, and willingness to provide their name and telephone number.

The August 4 pretest was used to test the field implementation of the cellular-phone translation service described in Section 3.2.4. Pretest interviewers identified a Portuguese-speaking angler and used the cellular-phone translation service to conduct the interview. The interviewers approached the angler, identified that he spoke Portuguese, contacted a Portuguese translator, and administered the survey by cellular phone. The interviewer explained the survey and asked the translator the survey questions, the translator translated the survey explanation and questions to the angler, the angler responded to the translator, the translator translated the responses for the interviewer, and the interviewer recorded the answers. Because the cellular-phone translation service is a relatively new survey method, the pretest helped ensure that anglers will be receptive to completing the survey through a real-time cellular phone translator.

Interviewers also had informal discussions with anglers on the Hackensack and Passaic Rivers between July 17 and August 4. These informal discussions provided additional site-specific information that was helpful in developing the protocols for each interview location and for the initial interview approach.

3.2.2 Questionnaire Design And Protocols

The interviewers will attempt to interview every person leaving the day's designated sampling location with fishing/crabbing gear and/or one or more fish/crabs. If two anglers leave at the same time, the interviewers will split up, and each will interview one of the departing anglers. If more than two anglers leave at the same time, the interviewers will attempt to interview all the anglers in turn. If the anglers will not wait and choose to leave while the interviewer completes an interview, the interviewers will complete a Missed Creel Report on the departing, uninterviewed angler(s) (See Appendix D for the Missed Creel Report). If someone is only leaving the site temporarily (e.g., the

angler has left his or her gear while going to get food or a beverage), he or she will not be interviewed. If an angler refuses to be interviewed, then the interviewers will complete a Missed Creel Report. The Missed Creel Report ensures that some data are collected for each of the individuals fishing and/or crabbing at an interview location when that location is sampled.

The on-site exit interviews will gather information on anglers' catch and behavior along the Passaic River. The purpose of the interviews is to learn more about the types of fish and crabs people are catching, keeping, and eating from the Passaic River. The result of each interview will provide information on anglers' frequency of fishing and crabbing in the Passaic River Study Area, what they are catching and how they are consuming their catch if they keep it, and their demographic characteristics.

During the On-Site Interviews, the boat team will contact the interviewers during each run to tell them how many persons the boat team observes fishing and/or crabbing at the interview location. The boat team will call the interviewers even if they do not observe any fishing and/or crabbing activity at that location on a particular run. The purpose of this contact is to ensure that the interviewers are aware of all persons fishing and/or crabbing at the interview location. Some locations are long or it is difficult to see the entire shoreline to determine from land alone whether anyone is fishing and/or crabbing at that location. The boat team's view of the interview location from the water will help support the interviewers.

3.2.3 Eligibility Criteria

The interviewers will attempt to interview any person age 18 or older who is fishing and/or crabbing at the interview location or who is in possession of fish, crab, or eel at the interview location. Possession of fishing and/or crabbing equipment is not required for an interview. If the interviewers are unsure whether a person qualifies to be interviewed based on his or her age, they will ask before beginning the interview. Persons age 17 or

younger are not interviewed. The interviewers will complete a Missed Creel Report for any person under 18 years of age.

The interviewers will attempt to interview every angler who is fishing and/or crabbing at the interview location, regardless of how long he or she has been at the location and regardless of whether the angler catches any fish or crabs. If an angler is interviewed, leaves the location, and returns later during the survey interval to fish and/or crab again, the angler will be interviewed again. The interviewers will complete a new interview form for the second interview, treating each encounter with an angler as if the angler is fishing and/or crabbing at that location for the first time.

3.2.4 Conducting the Interview

Each interview will be conducted in two steps. In the first step (i.e., the initial approach), the interviewers will introduce themselves, explain the survey, and, if the angler agrees to participate, will ask the fishing and crabbing frequency questions and the angler demographic questions. The second step of the interview (i.e., the final approach) will be performed when the angler is done fishing and/or crabbing.

During the initial approach, the interviewers intercept the angler while he or she is fishing and/or crabbing and assess the language they should use to conduct the interview. The interviewers will be fluent in English, Spanish, and/or Portuguese. For any other language, the interviewers will present the angler with a multi-lingual card that explains that the interviewer is conducting a survey and would like the angler to participate. The card instructs the angler to point to YES if he or she is willing to participate or NO if he or she is unwilling to participate. If the angler is willing to participate, the interviewer calls AT&T's translation service and asks for an interpreter for the language the angler pointed YES in. The interviewer provides the angler with a cellular telephone, and the translation service establishes a three-way connection to conduct the interview. The interviewer asks the question, the translator translates for the angler, the angler answers,

the translator translates for the interviewer, and the interviewer records the answer. Table 3-2 provides the English version of the text that appears on the interviewer's multi-lingual card.

During the final approach, interviewers will approach the angler and ask about his or her catch and how many kept fish or crabs will be eaten. The two-step approach was adopted to reduce respondent burden when the angler is done fishing and/or crabbing. The initial approach will take only a few minutes and the interviewers will be able to develop a positive rapport with the anglers before initiating the final approach.

Table 3-2: English Version of Multi-Lingual Text for Cellular Phone Translation

ENGLISH
Hello. I hope your fishing is going well. I am conducting a study of fishing and crabbing in the Passaic River. The purpose of this study is to learn more about the types of fish people are catching, keeping, and eating. I would like to talk to you about your fishing when you are ready to leave. Please point to the "YES" or "NO" below so that I will be able to call someone who speaks your language.
Yes, I will talk to you No, I do not wish to talk

The method by which the interviewer approaches the angler can affect the angler's willingness to participate in the survey. The interviewers will assess the scene when they arrive at the interview location. The interviewers will wait at least 10 minutes before approaching any angler so that they have sufficient time to assess the scene and identify which persons should be approached for interviews. When an angler begins fishing and/or crabbing at a site, the interviewers will wait for the angler to set up for fishing and/or crabbing. The interviewers will have discretion as to how long to wait before approaching an angler if they think the angler needs additional time to comfortably settle into the activity and be receptive to their approach. Interviewers will not approach an angler before he or she begins fishing and/or crabbing.

After waiting an appropriate amount of time, the interviewers will approach the angler

while he or she is fishing and/or crabbing. The interviewers will approach the angler in such a way that the anglers can see them coming. The interviewers will position themselves near the angler in a place that does not interfere with the angler's fishing and/or crabbing activity.

3.2.5 The Interview Form

As shown in Appendix C, the interview form will collect information on the angler's catch, plans for consumption of the catch, fishing and crabbing frequency, and demographics. The interviewers will ask each question exactly as it is worded on the interview form. If the angler has been interviewed previously and has concerns about answering the same questions, the interviewers will only ask the questions marked with an asterisk on the interview form. Most of the demographic questions will only be asked during the initial interview.

3.2.5.1 Initial Approach

Questions 1 through 7, Questions 12 through 15, and Questions 23 through 32 will be asked during the initial approach. Question 1 asks the angler if he or she has previously been interviewed for this survey. If the angler answers YES, the interviewer will thank the angler for participating in the study and will explain the reasons for interviewing the angler again. Question 2 asks the angler what time he or she started fishing and/or crabbing at that location today. Question 3 asks the angler whether he or she only goes fishing, only goes crabbing, or goes both fishing and crabbing in the Study Area. The interviewers will show the angler the Study Area map on the front of the fish identification booklet as they ask the question, and will point to the river as they say "in this part of the Passaic River."[3] This question asks the angler about all of his or her

[3] The interviewer will continually point to the Study Area map for any question that references "this part of the river" (Questions 3-7 and 12-15).

activity on the Passaic River, whether that activity is only fishing, only crabbing, or both fishing and crabbing. Question 3 is NOT specific to the survey day's activity. It will be the interviewer's responsibility to read the question in its entirety so the angler understands the meaning of the question. For anglers who Only Go Fishing, the interviewer will continue with Questions 4 through 11. For anglers who Only Go Crabbing, the interviewer will continue with Questions 12 through 19. For the anglers who Sometimes Go Fishing and Sometimes Go Crabbing the interviewer will continue with Questions 4 through 19. If the interviewer must ask the angler Questions 4 through 19, the interviewer will indicate that he or she will first ask about the angler's fishing trips and then will ask about the crabbing trips.

Questions 4 and 12 ask how many times the angler went fishing/crabbing over a one-month period. For convenience and ease of recall, the question asks for the number of times the angler went fishing/crabbing in the previous month. The interviewer will fill in the blank for the previous month. For example, if the interview date is September 3, the interviewer will fill in August for the name of last month. This ensures that the angler will report the number of times he or she went fishing/crabbing over a full one-month period.

Questions 5 and 13 ask the anglers what months they usually go fishing and/or crabbing in this part of the river. The first letter of each month is listed in order from January in the top left corner to June in the top right corner to July in the bottom left corner to December in the bottom right corner. The question is not specific to the past year only, but rather the angler's typical seasonal fishing activity in the Study Area.

Questions 6 and 14 ask the angler how many years he or she has fished or crabbed in this part of the river. The question refers only to the number of years the angler has fished or crabbed in the Study Area, not the angler's total years of experience. To ensure that the anglers understand the distinction the interviewers emphasize "in this part of the river" while pointing to a map outlining the Study Area.

Questions 7 and 15 ask about fishing activity in the Study Area in the previous five years. The interviewers will read the question and then each year in succession. They will pause between each year allowing the angler to provide a YES or NO answer to each year after it is read. The interviewers will circle every year for which the angler responds YES. As in Questions 6 and 14, the question is concerned only with fishing and crabbing "in this part of the river", not fishing activity at any other waterbody or location above the Study Area. The interviewers will skip these questions if the angler responds to Questions 6 and 14 with zero years fished or crabbed.

Prior to asking Question 23, the interviewers will inform the anglers that the last few questions are the usual survey questions used to help analyze the information. This will serve as a useful transition to let the angler know that the interviewer will be asking demographic questions typical of any survey.

Question 23 through 29 ask the angler questions on age, gender, race, education, town of residence, zip code, and household income respectively. If the angler refuses to answer any of these questions, the interviewers will use a variety of techniques to help induce participation. For example, if the angler is near others, the interviewer can let the angler write in his or her answers. Allowing the angler to write in the answers allows for full cooperation and confidentiality among the angler's peers. The interviewers can also ask the angler to point to the category that best describes the category of their response (e.g., with education and income). The interviewers will be trained to be extremely sensitive to the angler's comfort level with these questions. Because anglers may not be comfortable answering these questions in a public forum, the interviewers will be instructed not to push the angler for participation.

Question 30 asks for permission to call the angler with follow-up questions. If the angler answers YES, the interviewer will continue with Question 31, which asks for the angler's telephone number. If the angler answers NO, the interviewers will continue with

Question 32. If the angler refuses to provide his or her telephone number, the interviewers will ask for only the first six digits of the number. These first six digits will be used to help identify the angler in future interviews.

Question 32 asks the angler for his or her first name. The angler does not need to provide a last name. If the angler refuses, the interviewers will ask for his or her initials. The angler's name along with their telephone number will be used to help link the angler's data across interviews conducted on different days.

After completing the initial approach, the interviewer will thank the angler for his or her participation, time, and patience. The interviewer will tell the angler that the interviewer would like to ask the angler a few questions when he or she is done fishing and/or crabbing. The interviewer will inform the angler that the questions are about the angler's catch and the interviewer must wait until the angler is done fishing and/or crabbing. The interviewer will point to the location where he or she will be stationed and that they would appreciate the angler waving when he or she is done fishing and/or crabbing so the interviewer can ask the final few questions.

3.2.5.2 Final Approach

During the final approach, the interviewers will ask the anglers about the fish and or crabs they have caught that day. The interviewers will approach the anglers when the anglers are finished fishing and/or crabbing. The interviewers will wait for the angler to signal that they are done fishing. If the angler does not signal the interviewer, but is clearly packing up his or her gear to leave the location, the interviewer will approach the angler.

The interviewer will remind the angler that the interviewer has a few more questions to ask specifically about the angler's catch. The interviewer will ask the angler Questions 8 through 11, Questions 16 through 19, and Questions 20 and 21.

Questions 8 and 16 ask the angler if he or she caught any fish or crabs that day. If the angler answers YES, the interviewer will continue with Question 9 or 17. If the angler answers NO, the interviewer will continue to Question 21 if fishing and/or crabbing only, or Question 12 and then 21 if both fishing and crabbing.

Questions 9 and 17 ask the angler how many fish or crabs he or she caught that day. This number includes ALL fish or crabs caught by the angler, including any catch that was given away or thrown back. The interviewer will count only those fish or crabs caught by the interviewed angler. The interviewer will not count any fish or crabs caught by anyone other than the angler being interviewed.

Questions 10 and 18 ask the angler how many fish or crabs he or she kept. This is the number of fish or crabs in the angler's possession when he or she is interviewed. It includes any fish or crabs that the angler will give away after he or she leaves the fishing/crabbing location. For example, the angler may give away some of his or her catch to friends and relatives when he or she goes home. This number must be less than or equal to the number reported in Question 9 and 17. If this number is more than the number reported in Question 9 and 17, the interviewer will repeat the question. If the angler still reports a greater number of fish or crabs kept than caught, the interviewer will repeat Questions 9 and 17. The angler could have received catch from another angler and might be counting that catch in the total number of kept fish or crabs. The interviewer will instruct the angler that he or she wants the total number of fish or crabs that the angler personally caught that day and is keeping.

Questions 11 and 19 ask the angler how many fish or crabs he or she gave away that day. Any catch that the angler plans to give away later should be included in the number reported in Question 10 and 18. This number must be less than the number reported in Question 9 and 17. The sum of Questions 10 and 11 and 18 and 19 must be less than or equal to the number reported in question 9 and 17. If these are not equal, the interviewer will repeat Questions 11 and 19, 10 and 18, and 9 and 17. The interview will not

continue until the number in Question 9 and 17 is greater than or equal to the sum of the numbers in Questions 10 and 11 and 18 and 19.

Question 20 asks the angler for his or her permission to take a photograph of the respondent's creel. If the angler asks why a picture is necessary, the interviewer will tell the angler that the photograph will help scientists determine the types and size of the fish and crabs people are catching and keeping from the Passaic River.

If the angler allows the interviewer to take the photograph, the interviewer will write the date, time, camera number, and picture number with a black marker on an index card. The interviewer will prepare the index card after the initial approach to save time during the final approach. The interviewers will ask the angler if he or she is willing to spread the catch out on a plastic tarp. If the anglers are willing to spread out the catch, the interviewer will place a measuring tape next to a fish or crab, place the index card on the tarp, and take a photograph. If the angler is unwilling to remove the fish or crabs from a bucket or stringer, the interviewer will place the measuring tape over the bucket or next to the stringer and take the photograph with the index card in the picture. The interviewer will write the camera number and photograph number in the appropriate spaces on the front of the form beneath the interviewer box.

If the angler refuses to allow a photograph to be taken, the interviewer will continue with the catch table under Question 20.

For the catch table, the interviewer will ask the angler about the fish or crabs he or she has kept. The interviewer will complete a line of the table for each species kept and then will ask each question in succession from left to right across the table. The interviewer will point to a fish or crab that the angler has kept and ask the angler for the species name of this fish or crab. The interviewers will refer to their field identification guide to help identify fish they or the angler cannot easily identify. The interviewer will then ask how many of each species the angler has kept. The sum of the column must equal the number

of fish and crabs reported in Questions 10 and 18.

The interviewer will then ask the angler for permission to measure each fish or crab of that species. The interviewers will measure the length of each fish from the tip of the head to the tip of the tail and will measure the length of each crab across the widest part of the body. If the angler will not permit the interviewer to measure the fish or crabs, the interviewer will ask the angler to estimate the length of each fish/crab. If the angler does not provide an estimate, the interviewers will record their best estimate of the length of each fish or crab.

The number in column 4, how many of these fish/shellfish are going to be eaten, must be less than or equal to the number of fish/shellfish in column 2. Similarly, the number of children under 15 years of age and the number of pregnant or nursing women who will eat the fish/shellfish must be less than or equal to the number of people who will eat the fish in column 5.

Question 21 asks if the angler knows whether the State of New Jersey has warned anglers not to eat fish or crabs caught from the Study Area. If the angler answers NO, the interviewer will continue to Question 23. If the angler answers YES, the interviewer will continue with Question 22. Question 22 asks about changes in behavior because of the warnings. The interviewer will read and have the angler respond separately to each of the four parts of the question.

After completing the survey, the interviewer will thank the angler for his or her participation in the survey and ask whether he or she ever fishes and/or crabs in the Study Area at night (Question 34). For Question 33, the interviewer will record the angler's vehicle license plate number to help identify anglers across different interviews.

3.2.6 Missed Creel Report

The Missed Creel Report records information on any angler who is at the interview location but not interviewed. As described previously, there are three main reasons the Missed Creel Report may be used instead of an interview form.

1. the angler is under 18 years of age, so he or she is not eligible to be interviewed,
2. the angler refuses to participate in an interview, or
3. the angler leaves the location before the interviewer is able to speak with the angler.

Question 1 asks if the interviewer remembers interviewing this angler previously. Question 2 records the time when the angler begins fishing and/or crabbing. If the angler was fishing and/or crabbing before the interviewer arrived at the location, the interviewers will leave this blank. For Question 3 the interviewers will note the appropriate activity(ies). If the angler was only fishing, the interviewer will complete Questions 4–6. If only crabbing, the interviewer will complete Questions 7–9, and if both fishing and crabbing, the interviewer will complete Questions 4–9.

For Questions 4 and 7 the interviewer will observe the angler while he or she is fishing/crabbing and will determine whether the angler catches anything. For Questions 5 and 8 the interviewer will note whether the angler kept his or her catch. If the angler does not have a bucket or stringer or other means by which to transport catch, the angler is not likely to be keeping his or her catch. For Question 6 and 9 the interviewer will record whether the angler gave any fish/crabs away.

For Questions 10, 11, and 12 the interviewer will note the angler's age, gender, and race. If the interviewer believes the angler's race is not listed on the form, then the interviewer will circle Other and will fill in the blank next to that category. If the interviewer cannot determine the angler's race, the interviewer will circle Don't Know.

The interviewer will write the angler's name or other distinguishing characteristics if known in Question 13 and then will record the angler's vehicle license plate number in Question 14. In Question 15 the interviewer will record the reason for completing the Missed Creel Report.

4.0 SAMPLING SCHEDULE AND IMPLEMENTATION

The CAS sampling schedule (including its derivation and the number and type of sampling days) and its implementation (i.e., field procedures) are described in this section.

4.1 SAMPLING SCHEDULE

Water-based angler counts (see Section 3.1) and land-based interviews (see Section 3.2) will be conducted on 100 days of the CAS's one-year duration: August 1, 2000 through July 31, 2001. One team on a boat will count anglers over the length of the entire Study Area approximately every hour and another team will interview anglers by land at randomly selected public-access locations in the Study Area. Additionally, water-based angler counts will be conducted on another 50 days during the CAS's one-year duration. Thus, the CAS will result in angler counts on 150 days (approximately 41-percent of the days in one year). The 50 count-only days will provide the opportunity to quantitatively evaluate potential suppression effects of on-site interviews in the Study Area. This will be accomplished using multivariate statistical analysis to compare the angler counts on count-only days with the angler counts on count-and-interview days. If this analysis reveals that fewer anglers use the Study Area on count-and-interview days than on count-only days, then this will be evidence of a suppression effect, which will then be quantitatively incorporated into the risk assessment. If there is no statistical difference in the number of anglers on count-and-interview days relative to count-only days, then there is no suppression effect and no need to adjust the risk assessment.

A sampling simulation model was used to aid in the design of the CAS sampling schedule (see Appendix E). This model used a Monte-Carlo-type approach to establish a set of hypothetical trips to the Study Area and then to simulate the estimated total number of trips to the Study Area that would be intercepted under three alternative sampling

designs that were specified in the ESP. Multiple simulations were conducted so that the proportion of trips intercepted by candidate sampling designs could be statistically evaluated. The simulation was used to primarily address issues related to the amount and allocation of sampling effort for the CAS. The results of the simulation suggested that gains in the precision of estimates of angler use of the Study Area increase as the number of days of sampling increases. However, incremental gains become progressively smaller after about 100 days of sampling effort; hence, 100 days represents an efficient sampling effort. With 100 days of sampling effort, contact with frequent Study Area users is highly probable.

In addition, previous water-based reconnaissance in the Study Area suggested that the population of anglers using the Study Area is relatively small. As an example, the results of a recent reconnaissance performed by CLH indicate that less than 5 anglers use the Study Area on weekdays, and this number increases only slightly (i.e., up to 10 anglers) on weekends during ideal summertime conditions. The results of this reconnaissance are provided in Table 4-1.

This CAS sampling schedule is designed to obtain accurate angler counts and to maximize the number of possible angler interviews given the logistical characteristics of the Study Area. The allocation of sampling days is based on the simulation results that were used to determine the most likely periods of relatively high use of the Study Area and the most efficient number of survey days. *Proportionally*, the greatest sampling effort will be devoted to summer weekends, then, in declining order of intensity, spring weekends, summer weekdays, spring weekdays, fall weekends, fall weekdays, winter weekends, and winter weekdays. However, weekdays as a group will receive more *total* sampling effort in all seasons, because the number of weekdays in a year greatly exceeds the number of weekend days.

Table 4-1: Passaic River Study Area

Preliminary Angler Counts – June 22–25, 2000

Date	AM or PM	Weather	Departure Time	Return Time	Number in Party	First Time Seen	Last Time Seen	Activity	Location
6/22/00	AM	Cloudy; 75	6:30	13:00	0				
6/22/00	PM	Sunny/Partly Cloudy; 85	13:20	20:00	1	15:20	18:10	Fish	Hess Station
6/23/00	AM	Sunny; 75	6:00	13:00	1	8:35	9:15	Fish	Hess Station
6/23/00	AM	Sunny; 75	6:00	13:00	1	11:45	12:45	Fish	Hess Station
6/23/00	PM	Sunny; 88	13:00	20:00	1	13:26	16:00	Fish	Hess Station
6/23/00	PM	Sunny; 88	13:00	20:00	1	15:15	16:00	Fish	Hess Station
6/24/00	AM	Partly Cloudy/overcast; 75	6:00	12:50	4/3	10:15	12:30	Fish	Between Bridge Street Bridge and Amtrak Bridge
6/24/00	AM	Partly Cloudy/overcast; 75	6:00	12:50	3	12:05	12:35	Fish	Hess Station
6/24/00	PM	Sunny; 88	13:00	20:00	0				
6/25/00	AM	Partly Cloudy; 70	6:05	13:00	2	7:50	11:50	Fish	Hess Station
6/25/00	AM	Partly Cloudy; 70	6:05	13:00	1	11:50	11:50	Fish	Hess Station
6/25/00	AM	Partly Cloudy; 70	6:05	13:00	1	11:50	11:50	Fish	Hess Station
6/25/00	AM	Partly Cloudy; 70	6:05	13:00	1	11:50	11:50	Fish	Hess Station/Bridge St. Bridge
6/25/00	PM	Sunny; 89	13:10	20:00	1	14:00	16:45	Fish	Hess Station
6/25/00	PM	Sunny; 89	13:10	20:00	1	14:00	16:45	Fish	Hess Station
6/25/00	PM	Sunny; 89	13:10	20:00	1	14:00	16:45	Fish	Hess Station
6/25/00	PM	Sunny; 89	13:10	20:00	3	14:00	16:45	Fish, Crab	Hess Station
6/25/00	PM	Sunny; 89	13:10	20:00	1	15:40	16:45	Fish	Hess Station
6/25/00	PM	Sunny; 89	13:10	20:00	1	15:40	16:45	Fish	Hess Station
6/25/00	PM	Sunny; 89	13:10	20:00	3	16:00	16:15	Fish	Kearny Boat Ramp

There are two key benefits to the dual approach in the CAS:

1. The water-based component of the CAS will provide frequent counts of people fishing/crabbing in the Study Area. This will facilitate a more accurate estimate of the total population of anglers using the Study Area. As explained below (Section 4.4), the CAS will also use the angler counts to develop the weights for randomly selecting the land-based interview locations. This maximizes the number of interviews of anglers in the Study Area over the duration of the CAS.

2. The land-based interviews will provide total creel data for a subset of the anglers using the Study Area. By randomly selecting the interview locations, these data can be used to develop creel estimates for all anglers using all of the fishing/crabbing public-access locations in the Study Area.

Both elements of the CAS dual approach are well supported in the literature. The water-based approach will provide essentially instantaneous counts of anglers throughout the Study Area during a survey day (Amesbury, Sherwood, and Davis, 1991; Palsson 1991). Instantaneous counts are preferred to periodic counts during a day that may omit anglers who only fish or crab for a short time. This is particularly important given the expected small total population of anglers using the Study Area. On-site interviews have been used in numerous state and federal creel/angler surveys and represent the best available method for documenting an angler's total catch for a given day. The most notable example of on-site interviews is the NMFS protocol used for interviews conducted at various locations along the East Coast, including New Jersey and New York (see NMFS, 2000 for a description of NMFS survey procedures and Terrestrial Environment Specialists, 1996 for an example of freshwater interviews).

4.2 On-Site Counts

For the options evaluated in the sampling simulation (see Appendix E), the most precise

estimates of angler use of the Study Area were obtained when the total sampling effort was allocated using a stratified design with respect to:

- Seasons of the year (i.e., winter, summer, spring, and fall),
- Day types (i.e., weekdays versus weekends/holidays) within each month of each season, and
- Intervals during the day (approximately one half of the daylight hours from sunrise to dusk).

The sampling effort by season and day-type strata based on the sampling simulation presented in Appendix E and including the addition of count-only days is shown in Table 4-2. The specific weekdays and weekends for counts during each month of each season will be selected at random using STATA, a commercial software program.

STATA will also be used to select early-daylight or late-daylight intervals for counting. For each sampling day, the total number of daylight hours will be determined, and that day's sampling will include half of the daylight hours rounded up to the nearest hour. For example, at the summer solstice, there are approximately 15 hours of daylight; hence, an 8-hour sampling period will be used in June. In the winter, there are approximately 9 hours of daylight, so a 5-hour period will be used in the winter months. The half-daylight sampling interval will be randomly selected to either begin at sunrise or end at dusk (30 minutes after sunset), thus ensuring complete coverage of all daylight hours and tidal regimes over the course of the study.

Table 4-2: Allocation of Sampling Days by Season and Day Type

		Weekdays			Weekends/Holidays		
	Total Surveyed Days	Counts and Interviews	Counts Only	Total	Counts and Interviews	Counts Only	Total
Summer							
June	16	7	3	10	4	2	6
July	16	7	3	10	4	2	6
August	16	7	3	10	4	2	6
Fall							
September	15	6	3	9	4	2	6
October	13	5	3	8	3	2	5
November	9	4	2	6	2	1	3
Winter							
December	8	3	2	5	2	1	3
January	9	3	2	5	3	1	4
February	8	3	2	5	2	1	3
Spring							
March	9	4	2	6	2	1	3
April	14	6	3	9	3	2	5
May	17	8	3	11	4	2	6
Total	150	63	31	94	37	19	56

This sampling strategy is based on observations made during multiple site visits and sampling activities conducted under the ESP and on the June 2000 site reconnaissance (see Table 4-1) devoted to counting anglers and noting the times and locations where they were present. The reconnaissance, which occurred during good summer weather and included both weekdays and weekends, indicated that individuals use the Study Area primarily during the middle of the day. Moreover, they use it much less very early or very late in the day. In addition, there does not seem to be a pattern of fishing related to tides in the Study Area. The chosen sampling strategy is planned to ensure, however, that no daylight hours will be missed in the CAS.

The sampling days presented in Table 4-2 involve sampling shifts that either start at dawn or end at dusk. The sampling days do not involve any sampling from dusk to dawn (i.e., night fishing) for the following reasons:

- The river within the Study Area contains a substantial amount of floatable debris that is difficult to see at night and can cause problems for a small boat
- Because the Study Area is located in a highly urban environment interviewer and respondent safety is compromised at night
- Currently there is no *a-priori* information to suggest that anglers are fishing and/or crabbing in the Study Area at night (this question will be investigated with Question 34 on the interview form)

The starting and ending times of each half-daylight interval will be modified on the 1st and 16th day of each month to reflect changes in the timing of sunrise and sunset. As shown in Table 4-3 for August through October of 2000, the count intervals will overlap slightly, which means that no portion of the daylight hours will be missed by the sampling. By sampling the Study Area more than 50% of the available angling hours each day, the sampling plan will produce more precise estimates of total angler use of the Study Area than has been obtained by most other published creel/angler surveys, which typically sample at a rate between 20% to 40% of the available angling hours.

The on-site count schedule for August through October of 2000 is shown in Appendix F. The on-site count schedules for November 2000 through July 2001 will be determined during the remainder of the survey administration, based on data collected in the prior month.

Table 4-3: Survey Intervals: August – October 2000

	Early Daylight Interval	Late Daylight Interval
August 1 – 15	0600 – 1400	1230 – 2030
August 16 – 31	0615 – 1415	1215 – 2015
September 1 – 15	0630 – 1330	1245 – 1945
September 16 – 30	0645 – 1345	1230 – 1930
October 1 – 15	0700 – 1300	1230 – 1830
October 16 – 31	0715 – 1315	1215 – 1815

4.3 On-Site Interview Schedule

As explained in Section 4-2, the on-site interviews will be conducted on 100 of the 150 days during which counts will be made. Once the 150 counting days are randomly selected based on the season, day-type, and time-of-day strata, STATA will be used to randomly select 100 on-site interview days. Thus, water-based counts will be made on the same days that land-based interviews will be conducted. The desired number of interview days of each day type within each season based on the sampling simulation in Appendix E is shown in Table 4-2. The days that were randomly selected for on-site interviews in August through October of 2000 are provided in Appendix F. The interview days for the remainder of the CAS will be determined during the remainder of the survey administration.

4.4 On-Site Interview Locations

Based on many years' experience working on the Passaic and specific reconnaissance prior to the CAS, and the pretest river reconnaissance, there are five specific public-access locations for fishing/crabbing in the Study Area:

- Riverbank Park in Kearny
- Pathmark Bulkhead in Kearny
- Hess gas station in Harrison
- Heliport in Newark
- Riverbank Park in Newark (Ironbound District)

Neither of the reconnaissance trips revealed any fishing/crabbing activity on private property. Moreover, legal issues prevent interviewing on private property. Thus, the on-site interviews in the CAS will focus on public-access fishing/crabbing locations.

To ensure complete coverage over the entire Study Area, the on-site interview locations will be randomly selected from among the five public-access locations for each survey interval using STATA. Weights for the random selection of interview locations will be based on the prior month's counts of anglers at each site (i.e., sites with more angling activity will be more heavily weighted than those with less activity). If the amount of fishing/crabbing activity at any of the sites changes over the course of the study period, the weights for the random selection process will be altered to reflect that changed activity. Moreover, if the angler counts reveal a frequently used site that is not a current interview site, then that site will be added to the list of interview locations. It will then be randomly sampled along with the original interview locations. If the angler counts reveal infrequently used, non-interview sites, demographic information from the counts (i.e., approximate age, race, and gender of anglers) will be combined with the interview data for the risk assessment. If the counts reveal fishing/crabbing activity on private property, those observations will be treated the same as the observations from infrequently used, non-interview sites.

The sampling weights assigned to each interview location for August through October are shown in Table 4-4. The August site-selection weights were based on the pretest boat

reconnaissance and a review of the preliminary angler counts by CLH summarized in Table 4.1. The September weights were re-estimated based on the results of the August counts. October's weights were re-estimated using the results of both the August and September counts. Each subsequent month's re-evaluation of weights will involve comparing the actual distribution of anglers at the five sites with the distribution of the previous two-month's weights. If needed, the subsequent month's sampling weights will be adjusted to reflect the previous month's results. Furthermore, if the counts identify other highly used, publicly accessible locations in the Study Area, those sites will be incorporated into future sampling weights. For simplicity, each month's weights will be rounded to the nearest 0.05.

Table 4-4: Interview Site Selection Weights

Month	RBP Kearny	Pathmark	Hess	Heliport	RBP Ironbound	Total
August	0.25	0.1	0.5	0.1	0.05	1.0
September	0.25	0.05	0.45	0.05	0.2	1.0
October	0.15	0.05	0.5	0.05	0.25	1.0

The interview locations selected for each survey day in August through October are shown in Appendix F. The interview locations for the remaining months of the CAS will be determined later.

4.5 Sampling Schedule Revisions for Inclement Weather

On any selected survey day, on-site counts and/or interviewing may not be feasible because of poor weather conditions. Such "Inclement Weather Days" will be determined by the field supervisor based on safety considerations for survey personnel (Appendix G). If no counting and/or interviewing takes place on a selected day as a result of inclement weather, then that day will be replaced with the next available day in the same strata (e.g., if a weekday is lost as a result of inclement weather, then it will be replaced with the next

available weekday that month). If inclement weather eliminates less than half of the survey interval on a selected day, then that day will not be replaced with another day.

The process for the chain-of-custody, entry, and management of the survey data is described in this section. The data analysis process is also summarized in this section.

5.1 DATA MANAGEMENT

At the end of each count interval, the counter will give the Angler/Crabber Counts forms to the field supervisor. The field supervisor and the counter will review each of the Angler/Crabber Counts forms to ensure that they are completed correctly and legibly. Similarly, at the end of each interview interval, the interviewers will give the interview and missed creel forms to the field supervisor. The field supervisor and the interviewers will review each of the forms to ensure that they are completed correctly and legibly.

After all forms are reviewed for completeness and legibility, the field supervisor will copy the forms and send them for data entry. The data on the forms will be double keyed and verified. The electronic data will be managed with STATA. Paper copies of completed survey forms will be stored securely for reference as needed.

5.2 DATA ANALYSIS

Data analysis in the CAS will be directed at providing survey weights for each angler and descriptive statistics for each of the variables measured in the survey. Summary statistics limited to variable ranges, means, and measures of dispersion will be computed. Data analysis will be performed only for those individuals in the sample. No inferential analyses regarding the fishing and crabbing population as a whole will be completed as part of the CAS. The raw survey data as well as the computed survey weights and descriptive statistics will be summarized in a commonly used electronic format (e.g., Microsoft™ Access or Excel database). All computations will be made using standard

commercial software. Additional data analysis to support quantification of the fish/crab consumption exposure pathways will be performed as part of the risk assessment.

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APPENDIX A. QUALITY ASSURANCE PROJECT PLAN

This appendix contains the QAPP for implementation of the Study Area CAS. The QAPP includes detailed procedures for ensuring that the DQOs for implementing the CAS, as described in Section 2 of this CASWP, are met.

Quality control and quality assurance standards and practices will be maintained for each phase of the survey research process following industry standards established by such organizations as the American Association of Public Opinion Research and the Council of American Survey Research Organizations. The QAPP describes the procedures to be taken during the implementation of the CAS to minimize anticipated and controllable sources of error in data collection and analysis.

Quality assurance for such projects depends in part on a corporate infrastructure designed to provide the highest quality data possible. The CAS will be implemented by professionals who have extensive experience in administering and conducting statistically designed public surveys, and the facilities and equipment necessary for the project.

A.1. SURVEY DESIGN

Section 2 of this CASWP specifies the DQOs for the survey design, and the steps that were taken during the development of this CASWP to meet these DQOs. Therefore, this QAPP is limited to the QA/QC procedures that will be applied during the implementation of the CAS.

A.2. PRE-TEST OF SURVEY INSTRUMENT

The questionnaires, procedures, and instructions (i.e., instruments) for the CAS were extensively pre-tested prior to full-scale implementation. Pretests were conducted from

July 17, 2000, through August 4, 2000. Table 3-1 provides the date, location, and purpose of each pretest component. The pre-test results were used to refine the survey instruments (i.e., questionnaire, procedures, and instructions). The pre-tests involved four key components: 1) one-on-one interviews conducted at a central location; 2) boat reconnaissance; 3) land reconnaissance; and 4) on-site, one-on-one interviews at locations that are similar and in close proximity to the Study Area. The purpose and results of each pretest are discussed throughout the workplan.

A.2.1. Language Barriers

Each survey team will include an individual who is fluent in English, Spanish, and/or Portuguese. The questionnaire will be translated into each language, and interviewers will administer the questionnaire in the appropriate language. (See Appendix C for Spanish and Portuguese interview forms.) The clarity, accuracy, and cultural appropriateness of the translations were evaluated during the one-on-one component of the pretest program and changes were made as required.

As described in Section 3.2.4, interviewers will use a two-stage approach to administer the survey in all other languages (i.e., languages other than English, Spanish, and Portuguese). In step one, the interviewer will gain the respondent's cooperation by providing a note written in the respondent's native language (see Table 3-2 in Section 3.2.4 for an example). The notes will be organized by language category to help expedite the process (e.g., romance languages will be grouped together on one note, while Far East languages will be grouped on a separate note). Once the respondent reads the note and agrees to continue, step two will involve the interviewer contacting AT&T's translation service. The interviewer and the respondent will each have a cellular telephone. The interviewer will call the AT&T language translation service number and request the appropriate language interpreter. The interpreter will then provide real-time translation. The interviewer will ask the questions, and the translator will repeat the questions in the respondent's language.

The respondent will answer the questions, and the interpreter will translate the answers into English for the interviewer to record.

A.3. SURVEY IMPLEMENTATION

The goal of the field implementation DQOs is to ensure that the sampling plan is being implemented as designed and that the survey is being administered as planned. These involve monitoring and supervising interviewers.

A.3.1. Training of Field Staff

Field staff required for the on-site survey will have a unique skill set. Interviewers will possess interviewing and language skills as well as knowledge of fish species and crabs. To meet this skill set, research staff will train field staff to conduct in-person interviews.

Training will involve the following:

- An overview of project-specific goals
- Interviewing techniques
- Survey conduct
- The need for sensitivity to the survey population
- Review of the survey instruments
- Practice using the survey instruments
- Techniques for gaining cooperation, particularly in suspicious populations and non-English speaking populations
- Fish species and crab identification

- Use of AT&T translation services for conducting telephone interviews of non-English speaking anglers.

Once the interviewers are trained, they will undergo a final screening to ensure their proficiency.

A.3.2. Monitoring and Supervision

A field supervisor will supervise and monitor the boat team and interview team for each sampling day. The supervisor will meet each team prior to the beginning of each shift. The supervisor will distribute all necessary equipment prior to the beginning of each shift (e.g., questionnaires and cellular telephones). The supervisor will check on the boat team and interview team throughout the shift to ensure that the sample design is being implemented as designed. The field supervisor will also meet with each team member at the end of the shift to review and check each completed questionnaire. The teams will be trained in the details of the sampling design by the project leader and field supervisor to ensure that the sampling plan is understood. The sampling plan random selections will be made (as appropriate) prior to each day's sampling activities.

A.4. Data Verification and Handling

Data verification ensures that the specified procedures for collecting the data were followed and data errors were checked. Data handling involves chain-of-custody issues, data coding and entry procedures, storing and backing up the data, and delivering the data in a useable form for analysis.

A.4.1. Coding and Data Processing

Angler enumeration forms will be reviewed for completeness and accuracy. Intercept interviews will be checked for completeness and consistency of responses. Paper questionnaires will be initially reviewed to make sure that the respondent's or interviewer's notes are considered, that answers are clearly marked, that questions requiring only one response are not inadvertently marked in two places, and that other causes of potential confusion are eliminated prior to data entry and data processing. The data will be entered manually. All data will be double keyed and reconciled by a third party.

A.4.2. Data Delivery

The data will be reviewed by research staff early in the data collection process and at randomly selected times throughout the administration. This will provide additional assurance that the data-entry system is performing properly. The raw survey data, the computed case weights, and descriptive statistics will be provided to USEPA in a commonly used electronic format.

APPENDIX B. ANGLER/CRABBER COUNTS FORM

Passaic River Creel/Angler Survey
Angler/Crabber Counts

Counter ______________________________

Date _______________ Start Location 1 8

Start Time __________ End Time __________

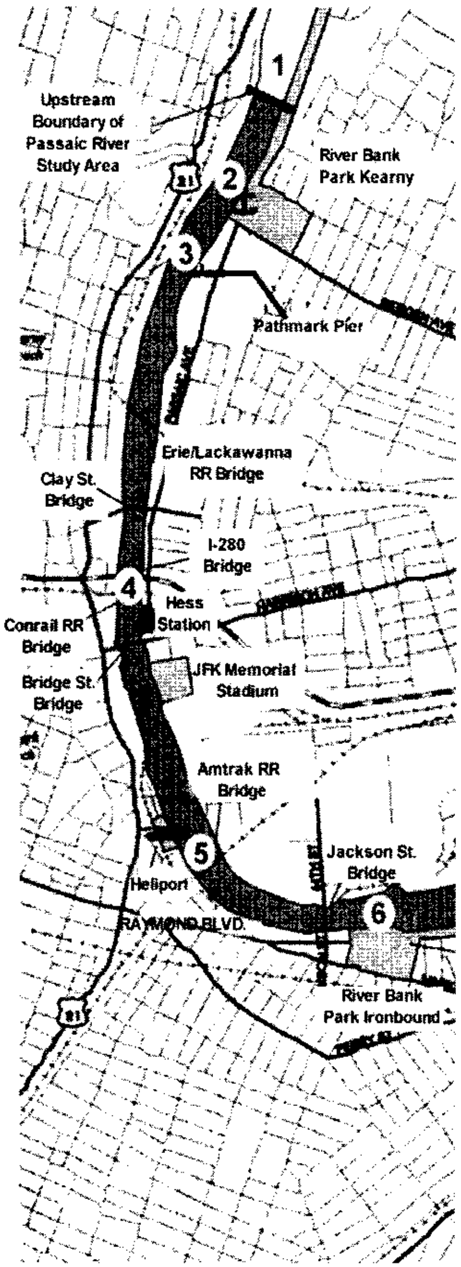
Sunny	< 32°	No precip.	No Wind
Partly Cloudy	33° – 49°	Drizzle	Some Wind
Cloudy	50° – 69°	Rain	Windy
Foggy	70° – 89°	Snow	
	>90°		

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________
			F C	F M	<15 15-59 60+	W NW ________



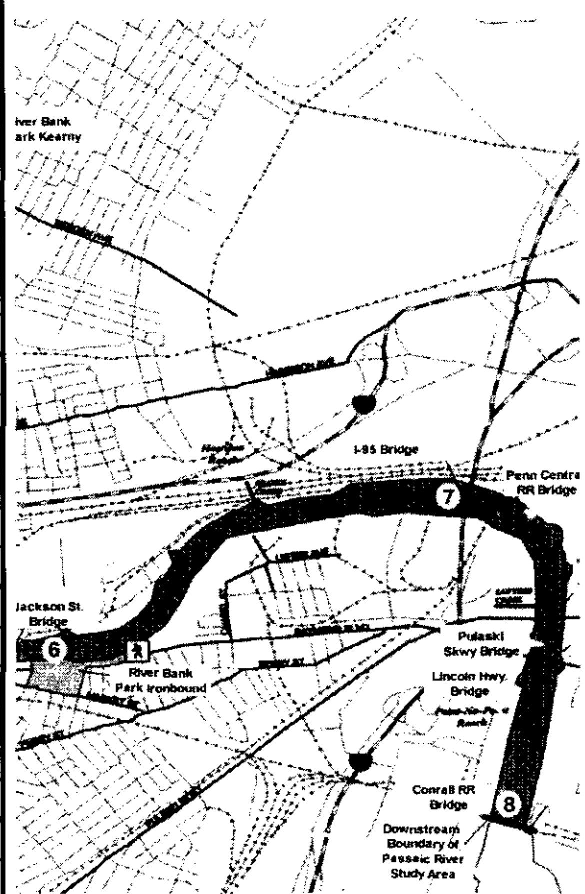
River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______

River Location		Riverbank	Type	Gender	Age	Race
1 2 3 4 5 6 7 8		E W	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
Time	# Fishing	# Crabbing	F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______
			F C	F M	<15 15-59 60+	W NW ______



APPENDIX C. INTERVIEW FORMS

*20) Can we take a quick picture of your catch and ask you a few questions about the fish/crabs you have kept? Yes No **(Go to Q. 21)**

Fish Information			Consumption by People					Preparation and Consumption of Parts						
Fish/Shellfish Species	Number of Fish/Shellfish	Measurement of Fish/Shellfish	How Many of These Fish/ Shellfish Are Going to Be Eaten?	What About Fish Not Eaten?	How Many People Will Eat These Fish/Shellfish Including Yourself?	How Many of These People Are Under 15 Years of Age?	How Many of These People Are Pregnant or Nursing Women?	How Will These Fish/Shellfish Be Cooked?	Will Anyone Eat the Head (or Mustard for Crabs)?	Will Anyone Eat the Tail Fin (or Claws and Legs)?	Will Anyone Eat the Internal Organs?	Will Anyone Eat the Body?	Will Anyone Eat the Skin? (N/A for Crabs)	Will Anyone Use These Fish/Shellfish for Stew, Soup, or Sauce?

21) Do you know if the state of New Jersey has warned people not to eat fish and crabs caught in this part of the river? Yes No **(Go to Q. 23)**

22) Because of these warnings, have you

A. Eaten fewer fish from this area? Yes No

B. Eaten fewer crabs from this area? Yes No

C. Fished less in this area? Yes No

D. Crabbed less in this area? Yes No

23) What month and year were you born? Month ☐☐ 19☐☐

24) Gender: Male Female

25) Are you: Hispanic Black Asian/Pacific Islander American Indian White Other _____ Don't know

26) What's your level of education? Some High School High School Graduate Some College College Graduate Some Graduate School

27) What town do you live in? _____

28) What's your zip code there? ☐☐☐☐☐

29) Is your total household income before taxes: < $10K $10K – $20K $20K – $30K $30K – $40K $40K – $50K > $50K

30) If we have any follow-up questions, can we call you? No **(Go to Q. 32)** Yes

***31)** What's your phone number? ☐☐☐-☐☐☐-☐☐☐☐

***32)** What's your first name? _____

***33)** _____

***34)** Do you ever fish and/or crab in this part of the river at night? Yes No

Questionário para pescadores à linha e cesto no Passaic River (Rio Passaic)
(Saída de versão de entrevista)

Entrevistador _____

Língua _____ Local 2 3 4 5 6

Início _____ Fim Horas _____ Data Horas _____

Introdução

Como é que vai essa pesca? Tem tido sorte? Ah, sim? E o que é que apanhou?

Estamos a fazer uma sondagem sobre a pesca e apanha de caranguejos no Passaic River. Será que podemos fazer-lhe algumas perguntas rápidas?

Sim Não→Tentada a conversão→Convertido? Sim Não→Falta de relatório de cabaz de peixe Camera # _____ Picture # _____

*1)	Já o entrevistámos anteriormente?	Sim **(Passe para o formulário de entrevista realizada de novo)**	Não	*2)	A que horas é que começou a pescar ou a apanhar caranguejos aqui hoje? ☐☐:☐☐ da manhã da tarde
*3)	Nesta parte do Passaic River:	Só pesca **(P. 4 - P. 11)**	Só apanha caranguejos **(P. 12 – P. 19)**	Às vezes pesca e às vezes apanha caranguejos **(P. 4 – P. 19)**	

Perguntas sobre a pesca (se aplicável)		**Perguntas sobre a apanha de caranguejos** (se aplicável)	
*4)	Quantas vezes é que pescou nesta parte do Passaic River em _____ (nome do mês anterior)? ☐☐ Número de vezes	*12)	Quantas vezes é que apanhou caranguejos nesta parte do Passaic River em _____ (nome do mês anterior)? ☐☐ Número de vezes
*5)	Em que meses é que costuma pescar nesta parte do Passaic River? Jan. Fev. Mar. Abr. Maio Jun. Jul. Ago. Set. Out. Nov. Dez.	*13)	Em que meses é que costuma apanhar caranguejos nesta parte do Passaic River? Jan. Fev. Mar. Abr. Maio Jun. Jul. Ago. Set. Out. Nov. Dez.
*6)	Durante quantos anos é que tem pescado nesta parte do Passaic River? ☐☐ Número de anos	*14)	Durante quantos anos é que tem apanhado caranguejos nesta parte do Passaic River? ☐☐ Número de anos
*7)	Pescou nesta parte do rio em: 1999? 1998? 1997? 1996? 1995?	*15)	Apanhou caranguejos nesta parte do rio em: 1999? 1998? 1997? 1996? 1995?
*8)	Já apanhou algum peixe hoje? Sim Não **(Passe à P. 12 ou P. 21)**	*16)	Já apanhou alguns caranguejos hoje? Sim Não **(Passe à P. 20 ou P. 21)**
*9)	Quantos peixes apanhou? ☐☐	*17)	Quantos caranguejos apanhou? ☐☐
*10)	Quantos peixes guardou? ☐☐	*18)	Quantos caranguejos guardou? ☐☐
*11)	Quantos peixes deu? ☐☐	*19)	Quantos caranguejos deu? ☐☐
(Passe à P. 12 ou P. 20)		**(Continue)**	

*20) Importa-se que tiremos uma fotografia rápida da sua pesca e que lhe façamos algumas perguntas sobre o peixe e os caranguejos que guardou? Sim Não **(Passe à P. 21)**

Informação sobre o peixe			**Consumo pelas pessoas**					**Preparação e consumo das partes**						
Espécies de peixe e marisco	Número de peixes e mariscos	Medidas dos peixes e mariscos	Destes peixes e mariscos, quantos serão comidos? E o peixe que não foi comido?	Quantas pessoas comerão estes peixes e mariscos, incluindo você?	Dessas pessoas quantas terão menos de 15 anos de idade?	Dessas pessoas quantas mulheres estarão grávidas ou a amamentar?	Como é que estes peixes ou mariscos serão cozinhados?	Alguém comerá a cabeça (ou a "mostarda" dos caranguejos)?	Alguém comerá o rabo (ou as navalhas e pernas)?	Alguém comerá os órgãos interiores?	Alguém comerá o corpo?	Alguém comerá a pele? (N/A para os caranguejos)	Alguém usará este peixe ou caranguejos para guisar, fazer sopa, ou molhos?

21) Sabe que o estado de New Jersey avisou as pessoas para que não comessem o peixe e os caranguejos apanhados nesta parte do rio? Sim Não **(Passe à P. 23)**

22) Devido a estes avisos tem

A. Comido menos peixe desta zona? Sim Não

B. Comido menos caranguejos desta zona? Sim Não

C. Pescado menos nesta zona? Sim Não

D. Apanhado menos caranguejos nesta zona? Sim Não

23) Em que mês e ano nasceu? Mes ☐☐ 19☐☐

24) Sexo: Masculino Feminino

25) É: Hispânico Negro Asiático/Ilhas do Pacífico Índio americano Branco Outra origem_____ Não sei

26) Quais são as suas habilitações literárias? Frequência de ensino secundário Diploma de ensino secundário Frequência de ensino superior Diploma de ensino superior Estudos universitarios adicionais

27) Em que localidade vive? _____

28) Qual é o código postal dessa localidade? ☐☐☐☐☐

29) Qual é o rendimento total do seu agregado familiar antes de deduzir os impostos? Menos de 10 mil dólares Entre 10 e 20 mil dólares Entre 20 e 30 mil dólares Entre 30 e 40 mil dólares Entre 40 e 50 mil dólares Acima de 50 mil dólares

30) Se quisermos fazer algumas perguntas de seguimento, podemos telefonar-lhe? Não **(Passe à P. 32)** Sim

***31)** Qual é o seu número de telefone? ☐☐☐-☐☐☐-☐☐☐☐

***32)** Qual é o seu primeiro nome? _____

***33)** _____

***34)** Alguma vez pescou peixe ou carangeijo a noite neste lugar do rio? Sim Não

Passaic River Creel/Angler Survey
(Versión de entrevista cuando saliendo)

Encuestador/a _____

Idioma _____ Lugar 2 3 4 5 6

Fecha _____ Hora de inicio _____ Hora de finalización _____

Introduction

Hola, ¿cómo está? ¿ha tenido suerte? ¿Sí? ¿qué pescó?

Estamos llevando a cabo una entrevista sobre la pesca de peces y cangrejos en el río Passaic. ¿Le podemos hacer algunas preguntas rápidas?

Si Continuar No → Usar protocolo de conversión → Convertido Sin convertir → Omitido el informe de la cesta de pescador Camera # _____

Picture # _____

*1)	¿Lo han entrevistado anteriormente?	Si **(Pasar al formulario de segunda entrevista)**	No	*2)	¿A qué hora empezó a pescar o ha sacar cangrejos hoy día?	☐☐:☐☐	a.m. p.m.
*3)	¿En esta parte del río Passaic, usted:	Sólo pezca **(Preguntas 4–11)**	Sólo saca cangrejos **(Preguntas 12–19)**	A veces pezca y a veces saco cangrejos **(Preguntas 4–19)**			
	Preguntas acerca de la pezca (Si se aplica)				**Preguntas acerca de sacar cangrejos** (Si se aplica)		
*4)	¿Cuántas veces pescó usted en esta parte del río en _____ (nombre del mes pasado?)	☐☐ Veces		*12)	¿Cuántas veces sacó cangrejos usted en esta parte del río en _____ (nombre del mes pasado?)	☐☐ Veces	
*5)	¿Normalmente en qué meses pesca usted en esta parte del río?	Ene. Feb. Mar. Abr. May. Jun. Jul. Ago. Set. Oct. Nov. Dic.		*13)	¿Normalmente en qué meses saca cangrejos usted en esta parte del río?	Ene. Feb. Mar. Abr. May. Jun. Jul. Ago. Set. Oct. Nov. Dic.	
*6)	¿Cuántos años lleva pescando en esta sección del río?	☐☐ Años		*14)	¿Cuántos años lleva sacando cangrejos en esta sección del río?	☐☐ Años	
*7)	¿Pescó usted en esta parte del río en:	1999? 1998? 1997? 1996? 1995?		*15)	¿Sacó cangrejos usted en esta parte del río en:	1999? 1998? 1997? 1996? 1995?	
*8)	¿Ha pescado algún pez hoy día?	Si No **(Pasar a la pregunta 12 ó 21)**		*16)	¿Ha sacado algún cangrejo hoy día?	Si No **(Pasar a la pregunta 20 ó 21)**	
*9)	¿Cuántos peces ha pescado?	☐☐		*17)	¿Cuántos cangrejos ha sacado?	☐☐	
*10)	¿Con cuántos peces se ha quedado?	☐☐		*18)	¿Con cuántos cangrejos se ha quedado?	☐☐	
*11)	¿Cuántos pescados ha regalado?	☐☐		*19)	¿Cuántos cangrejos ha regalado?	☐☐	
	(Pasar a la pregunta 12 ó 21)				**(Cotinuar)**		

*20) ¿Le importaría si tomamos una foto rápida de los que ha sacado y le hacemos unas preguntas acerca de los pescados o cangrejos con los que se ha quedado? Si No **(Pasar a la pregunta 21)**

Información de los peces			**Consumo por persona**						**Preparación y consumo de las partes**					
Especie del pescado/marisco	Número de pescados/mariscos	Medida de pescados/mariscos	¿Cuántos de estos pescados/mariscos se comerán? / ¿Qué del pescado que no vas a comer?	¿Cuántas personas más comerán estos pescados/mariscos, incluyéndose usted?	¿Cuántas de las otras personas son menores de 15 años de edad?	¿Cuántas de las otras personas son mujeres embarazadas o que están dando de lactar?	¿Cómo se cocinarán estos pescados/mariscos?	¿Comerá alguien la cabeza del pescado/marisco?	¿Comerá alguien la cola del pescado o tenazas y patas del cangrejo?	¿Comerá alguien los órganos internos?	¿Comerá alguien el cuerpo?	¿Comerá alguien la piel (no se aplica a los cangrejos)?	¿Cocinará alguien sopas, caldos o salsa con el pescado/marisco?

21) ¿Sabe usted que el Estado de Nueva Jersey le ha advertido a la población que no coma los pescados y cangrejos que se sacan en esta parte del río? Si No **(Pasar a la pregunta 23)**

22) Debido a estas advertencias, ¿ha

A. comido usted menos pescado de esta área? Si No
B. comido usted menos cangrejos de esta área? Si No
C. pescado menos en esta área? Si No
D. sacado menos cangrejos en esta área? Si No

23) ¿En que año nació usted? Mes ☐☐ 19 ☐☐ **24)** Sexo: Masculino Femenino

25) ¿Es usted: Hispano(a)? Negro(a)? Asiático(a)/Isleño(a) del Pacífico? Indio(a) Americano(a)? Blanco/a? Otro? _____ No sabe

26) ¿Cuál es su nivel de educación? Secundaria incompleta | Secundaria completa | Universidad incompleta | Universidad completa | Estudios graduados incompletos

27) ¿En qué pueblo vive? _____ **28)** ¿Cuál es su código postal? ☐☐☐☐☐

29) ¿Es el ingreso total de su hogar antes de impuestos: < $10,000 | $10,000–$20,000 | $20,000–$30,000 | $30,000–$40,000 | $40,000–$50,000 | > $50,000

30) ¿Lo(a) podemos llamar si tenemos alguna otra pregunta? No **(Pasar a la pregunta 32)** Yes

***31)** ¿Cuál es su número telefónico? ☐☐☐-☐☐☐-☐☐☐☐

***32)** ¿Cuál es su nombre? _____

***33)** _____

***34)** ¿Va usted de pesca o pesca cangrejas en esta parte del río de noche? Si No

APPENDIX D. MISSED CREEL FORM

Passaic River Creel/Angler Survey
(Missed Creel Report)

Interviewer _____

Location 2 3 4 5 6

Date _____ Exit Time _____ Report Time _____

1) Have you interviewed this angler previously?	Yes	Not Sure	No	**2)** What time did the angler start fishing or crabbing here today?	☐☐:☐☐ a.m. p.m.
3) Was the angler:	Only Fishing **(Q. 4 – Q. 6)**			Only Crabbing **(Q.7 – Q. 9)**	Both Fishing and Crabbing **(Q.4 – Q.9)**
Fishing Questions (If Applicable)				**Crabbing Questions** (If Applicable)	
4) Did the angler catch any fish today?	Yes	No **(Go to Q. 7 or Q. 10)**		**7)** Did the angler catch any crabs today?	Yes No **(Go to Q. 10)**
5) Did the angler keep any fish?	Yes	No		**8)** Did the angler keep any crabs?	Yes No
6) Did the angler give any fish away?	Yes	No		**9)** Did the angler give away any crabs?	Yes No
(Go to Q. 7 or Q. 10)				**(Continue)**	
10) What is the angler's age?	<15	15–59	60+	**11)** Gender:	Male Female

12) Race: Hispanic Black Asian/Pacific Islander American Indian White Other _____ Don't know

13) If you've interviewed this person before, do you remember this angler's first name? _____

14) _____

15) Reason for completing Missed Creel Report:

1) Angler unwilling to be interviewed
2) Angler unwilling to be re-interviewed
3) Angler left while other interviews were being conducted
4) Angler avoided interviewer

APPENDIX E. STUDY AREA SAMPLING PLAN DESIGN AND SIMULATION

An earlier draft of the CASWP proposed a roving, boat-based survey approach with randomly selected starting locations (i.e., timing markers) on the river. A sampling plan design and simulation were developed based on that approach. As explained in the CASWP, a revised approach evolved as a result of the numerous pre-tests conducted in July and early August of 2000. However, the CASWP still relies on the results of the earlier sampling simulation for the total number of survey days and the allocation of those survey days by month and by type of day (i.e., weekdays versus weekends/holidays). Therefore, the earlier simulation is presented in this Appendix.

E.1. CANDIDATE SAMPLING PLANS

The CASWP will include a stratified random probability sampling design to select the days of the year on which interviews are to be conducted. This type of design has been well established in the statistical literature as a preferred approach because it efficiently utilizes sampling resources while providing a solid statistical basis for subsequent data analysis.

Stratified random sampling is a standard technique routinely used in creel surveys and has been discussed by many authors including Cochran (1977), Kish (1965), and Hedayat and Sinha (1991). The stratified approach groups days into units (strata) that have relatively similar rates of Study Area visitation and then randomly selects days within these strata on which to conduct interviews. The year has been divided into three levels of strata: four seasons, three months within each season, and two day types within each month. Thus, $4 \times 3 \times 2 = 24$ strata exist. The seasons are three-month periods defined as follows:

- Fall: September, October, November
- Winter: December, January, February

- Spring: March, April, May
- Summer: June, July, August.

Days within each of these seasonal strata are delineated as either weekends/holidays or weekdays. The holidays are the 10 Federal holidays: New Year's Day, Martin Luther King, Jr. Day, President's Day, Memorial Day, the Fourth of July, Labor Day, Columbus Day, Election Day, Thanksgiving, and Christmas.

After the sampling days have been allocated to the season, the days are allocated to months within the season. The use of month and day strata is well-established in the creel survey sampling literature (see, e.g., Malvestuto and Knight, 1991; Sztramko, 1991).

A key issue in the specification of a stratified sampling plan is deciding how many days should be selected from each strata if a total of N interview days are available. During development of this CASWP, three alternative basic stratification approaches were considered, as defined in the ESP (approved April 6, 1999) and as discussed in more detail in the next three subsections. These three basic approaches were assessed theoretically and by using a sampling simulation model. The final allocation of sampling days was informed by those evaluations and by examining the literature on creel survey sampling.

E.1.1. First Candidate Plan

In the first stratified sampling plan (Plan #1), a block of 30 days is selected for interviewing in the Study Area in one summer month and in one winter month. In each of the remaining 10 months, two weekend days and two weekday days are selected randomly. This plan includes 100 days of sampling.

E.1.2. Second Candidate Plan

In the second stratified sampling plan (Plan #2), sampling days are allocated to strata by choosing days in proportion to the number of days in each stratum. For example, there are 66 summer weekdays. This approach would allocate 66/365 = 18 percent of the sampling effort to summer weekdays and a proportionate amount for the remaining strata. This type of selection is called selection with probability proportional to size (PPS). This PPS sampling plan spreads sampling effort evenly across the year.

E.1.3. Third Candidate Plan

In the third stratified sampling plan (Plan #3), sampling days are allocated according to previous estimates of seasonal variability in fishing effort. More intensive sampling occurs when more variability in the number of people potentially using the Study Area exists. In this approach, auxiliary information is used to allocate days to strata to reduce sampling variability.

E.2. Statistical Issues in the Evaluation of Sampling Plans

In statistical terms, a "population parameter" or simply a "parameter" is a property or value that is an inherent characteristic of the population, such as the true number of anglers that use the Study Area. An "estimator" represents the value for the parameter that can be calculated based on the information collected from a statistical sample of the population. A "sampling distribution" refers to the range and relative likelihood of the value of an estimator over several statistical samples from the population for the purposed of computing the estimator.

The sampling plans were assessed both theoretically and by using sampling simulation (Section E.6). Both of these methods focus on the sampling distribution of an estimator,

e.g., the number of anglers intercepted in the Study Area under each of the candidate sampling plans.

Various criteria are used to evaluate sampling approaches and the quality of estimators for a population parameter on the basis of the sampling distributions of the estimators. These criteria include: 1) bias; 2) variance; and 3) mean square error (MSE).

Bias is defined as the difference between the true population parameter value and the mean of the sampling distribution for the parameter. An estimate of the population parameter of interest is considered to be unbiased if the estimate made on the basis of the sample equals, on average, the true mean population value. The true amount of bias cannot generally be determined unless a complete census of the population is undertaken, in which case the issue of sampling is moot.

The variance of the sampling distribution is a measure of its spread. Variance measures the difference in estimates computed from the sample from the true population value. A fundamental result of sampling theory is that, regardless of the underlying distribution of the parameter in the population, the sampling distribution will be the normal distribution for a large enough number of repetitions of the sampling process. When using an estimator that is unbiased, finding a plan that has minimum variance is a priority.

The MSE is typically the focus when evaluating competing sampling plans because it evaluates both the bias and the variance of the sampling distribution. The MSE is the mean of the sum of squared deviations of the true population parameter from estimates made on the basis of a sample. The MSE equals the variance plus the square of the bias.

E.3. METHODS FOR EVALUATING SAMPLING PLANS

The theoretical basis used to evaluate the three candidate plans (i.e., stratified sampling approaches) was the two-step approach defined in the ESP (pp. 2-46 and 2-47). The first

step is to give the basic stratified sampling approach and total number of days. The second step is to find an allocation of sampling days to strata that minimizes the variance of the sampling distribution of the estimator.

In addition to the theoretical approach, an empirical approach was used to evaluate the candidate sampling approaches. This is the sampling simulation, described in detail in Section E.6. In this setting, alternative *hypothetical* true population parameter values are specified, and the ability of alternative sampling approaches to estimate these "truths" is evaluated by simulating empirical sampling distributions for the estimator. The hypothetical truths were selected to represent probable Study Area conditions.

The basic idea of the simulation can be understood from the steps used in constructing it.

1. A hypothetical "true" amount of visitation (anglers taking trips to fish or crab) to the Study Area is specified. This specification details who is visiting the Study Area, on which days of the year, at which times of the day, and at which locations in the Study Area.

2. On the basis of the particular sampling approach being evaluated, an interviewing schedule in the Study Area is selected that includes the set of days and times of day the interviewers pass by each timing marker and observe anglers fishing or crabbing at locations between the timing markers.

3. The "true" visitation scheme is compared with the candidate sampling approach's interviewing schedule to identify the anglers who would be intercepted when that sampling approach is used. This comparison obtains hypothetical "data" on Study Area visitation that would be collected under the candidate sampling approach.

4. The hypothetical data are used to construct an estimate of total angler visits to the Study Area during the year.

5. The result of Step 4 is compared with the hypothetical "true" number of visits. This result is a point on the sampling distribution of total visit estimates.

6. Steps 2 through 5 are repeated enough times to stabilize the shape of the sampling distribution to the expected normal distribution for each of the three candidate sampling approaches. The sampling simulation uses 5,000 iterations of this process to give 5,000 points on the sampling distribution of total visits for each candidate sampling approach.

7. The results of Steps 1–6 are evaluated for each sampling plan. In the sampling simulation used here, the MSE is used to evaluate alternative stratification bases, the amount of time to survey within a day, and the changes in the time interval between reaching sampling locations. Both the MSE and the frequency of contact with anglers are used to evaluate the number of days to survey within the year.

8. To prevent the conclusions from being made solely on the basis of one particular hypothetical truth, all the steps are repeated 30 times for each candidate sampling plan, and the results are averaged.

The sampling simulation was used as part of the DQO process to assess aspects of the design of the sampling plan for the on-site survey. The sampling simulation was used to gain insight into the issues involved in sample design for the on-site survey. It was *not* intended to, nor can it, provide a measure of the sampling error involved in the actual on-site survey where the true pattern of visits is not known.

E.4. SELECTION OF SAMPLING DAYS IN THE YEAR

E.4.1. Theoretical Assessment

Let N_h be the total number of days in stratum h, and n_h be the number of days selected for sampling in stratum h, for h=1,...,24. Selection of the number of days to sample within each stratum depends on what is being estimated and its variance across strata.

Estimates of population means and totals obtained by using sample means and totals as estimators are unbiased under conditions of stratified random sampling (Levy and Lemeshow, 1991). Estimates of population means and totals with minimum variance are estimated by using sample sizes across strata, given by:

$$n_h = n(N_h \sigma_{hx} / \Sigma_h N_h \sigma_{hx})$$

where n is the total sample size, n_h is the number of days selected from stratum h, N_h is the total number of days in stratum h, x is the population parameter being estimated, and σ_{hx} is the standard deviation (square root of the variance) of x in stratum h. This equation was formulated by Neyman (1934) and is called Neyman's optimal allocation. The usual optimal allocation considers the cost of sampling and balances the gains from sampling a highly variable strata against the costs of doing so (e.g. Hedayat and Sinha, 1991, p. 269). The version of the optimal allocation presented in this Appendix ignores the cost of sampling and only considers the benefits. This allocation of days to strata will also minimize the MSE because, with zero bias, the MSE equals the variance.

The conclusion to be made from the theoretical assessment is that allocations of days to strata should be made on the basis of auxiliary information *if* such information accurately measures the variance in visits to the Study Area across months of the year. More sampling effort is needed when what is being estimated is more variable.

E.4.2. Assessment Based on Simulation

Detailed results of the sampling simulation studies are presented in Section E.6.2. The first conclusion to be drawn from the simulation is that the Plan #1 plan leads to a higher MSE than either of the other two plans. In addition, the simulation demonstrated that, in most

situations, the MSE is lower when a stratified sampling plan allocates days to strata on the basis of auxiliary information about intra-year variability in fishing and crabbing effort. However, for some hypothetical truths, Plan #3 has a higher MSE than does Plan #2. The variance of the MSE across proposed truths was larger for Plan #3 than for Plan #2 because the hypothetical truth admits that there is some chance that visits will be made in the winter. Therefore, winter visits exist for some hypothetical truths, but Plan #3 allocates very little effort to winter sampling. For these "truths," the gains in accuracy for the summer and spring obtained by using Plan #3 sampling were insufficient to offset the loss in accuracy in estimating winter and fall visits.

Assessing the accuracy of the information regarding potential variance in visits is important in selecting a sampling approach. One conclusion drawn from the simulation is that if one bases the sampling plan on the Neyman optimal allocation of days to strata but the information employed regarding periods of higher variability of use is not sufficiently accurate, the "optimal" allocation does worse than a more even distribution of effort.

E.4.3. The On-Site Sample Allocation

On the basis of theoretical considerations and simulation results, as well as literature review and recommendations of statisticians who participated in the CAS design, a stratification approach was chosen for the CAS to balance gains from matching the allocation of days to strata with estimates of intra-year variability in fishing and crabbing effort against the reliability of the information and the potential for loss of accuracy if winter visitation is greater than expected. A sampling plan was chosen that balances Plan #2 (which allocated sampling days in proportion to the number of days in each stratum) with Plan #3 (which bases the allocation entirely on auxiliary information on Study Area visits and the Neyman optimal allocation).

This approach is supported by the literature on creel surveys (Malvestuto and Knight, 1991; Malvestuto, 1996), which, for example, favor allocation of more sampling days to summer months than to winter months.

Site-specific quantitative data does not exist for estimating the variance in the number of trips taken in the Study Area. The allocation of days to strata was assessed by using three sources of information: 1) site-specific qualitative research; 2) information on fishing across the year and across days from a study of urban fishing in the Pittsburgh, Pennsylvania, area (the Three Rivers Study); and 3) results of the sampling simulation.

Variability in effort was estimated from three sources. First, the general character of fishing was determined through qualitative research interviews with a bait-and-tackle store owner in Lyndhurst, New Jersey, and with a boat yard operator in Kearny, New Jersey. Second, qualitative interviews were conducted with fisheries biologists Bob Papson of the New Jersey Department of Fish, Game, and Wildlife and Dr. Paul Jivoff of Rutgers University. Third, data from a year-long study of urban angling in the Pittsburgh area were examined (Terrestrial Environmental Specialists et al. 1996). Although the Pittsburgh area is not close to the Study Area, the Three Rivers Study provides some insight into fishing in the Study Area because both areas are urban river areas with similar climates. The Three Rivers Study data show seasonal and weekday/weekend variability in estimated trips. Such weekday/weekend differences have been found in many creel surveys.

The qualitative research component showed a generally low level of fishing effort in the Study Area, as well as the following general use pattern during the year in proximity to the Study Area:

1. Anglers using the Study Area are not required to have fishing licenses because of the estuarine nature of the fishery.

2. Angling activity is very low in winter.

3. The period of greatest crabbing effort is from April to September, which is consistent with seasonal variations in crab abundance. Depending on the weather in a particular year, in early September, female crabs migrate to deeper, more saline water and leave the Study Area. Male crabs burrow into sediments and are unavailable for harvest beginning about the first of December. Female crabs return to less saline, shallower water, and males emerge there in early April.

4. According to Dr. Bob Papson, a New Jersey fisheries biologist, striped bass, blue back herring, and American shad increase in numbers in northern New Jersey rivers in the spring. This increase typically occurs starting in mid-April and ends in early June. This increase may result in a small increase in fishing effort in the spring. No corresponding increase exists in the fall. Additional information on the seasonal availability of various species was presented in Table 1-1 of this CASWP.

5. According to local qualitative research, angling effort in the area surrounding the Study Area is more likely to occur on weekends than on weekdays. This finding also was found in the Three Rivers Study.

This information was used to modify the allocation from Plan #2 to provide more sampling effort in the spring and summer and less effort in the fall and winter. Sampling effort is devoted to seasons more likely to have higher visitation because visitation and variability in visitation are positively correlated.

On the basis of theoretical results, the sampling simulation, qualitative research, and data from the Three Rivers Study, an allocation of days in the year by seasonal strata was selected, combining the stratification approaches of Plan #2 and Plan #3. As a logistical consideration, the selected approach also utilizes a number of days evenly divisible by three, which is the number of months in each season.

E.4.4. Total Sampling Effort

The simulation results showed that 100 days of effort would provide enough data using an MSE criterion (i.e., a sufficient proportion of hypothetical anglers would be intercepted). The MSE for Plan #2 was computed for various numbers of days of sampling effort. Substantial gains were obtained as effort was increased from 50 to 75 to 100 days. After 100 days, however, gains in MSE reduction from increasing effort were comparatively negligible. Moreover, a large proportion of the hypothetical anglers were intercepted under the simulated sampling regimens when 100 days of effort were used in the simulation. (See Section E.6 for details).

We chose 100 sampling days on the basis of the simulation results as well as on the basis of the desire to meet or exceed the level of sampling used in other creel surveys, with particular focus on those that have supported CERCLA risk assessments (e.g., SCCWRP and MBC, 1994; Bales, 1993). The days in the summer and the winter will be allocated equally to the months comprising them as specified in Table E-1. For example, the summer stratum would include 21 weekdays and 12 days on the weekend/holidays. Each of the three summer months would receive 7 weekday days and 4 weekend days of sampling effort. In the spring, because harvestable populations are absent in March but present in April and May; more sampling effort is exerted during April and May. In the fall and the spring, more days are allocated to the warmer months, as recommended by Malvestuto et al. (1978).

Table E-1: Seasonal Stratum Allocations

Stratum	Proportion of Total Days
Summer, weekday	0.21
Summer, weekend	0.12
Fall, weekday	0.15
Fall, weekend	0.09
Winter, weekday	0.09
Winter, weekend	0.07
Spring, weekday	0.18
Spring, weekend	0.09

The final allocation of sampling effort to each stratum is provided in Table E-2.

Table E-2: Sampling Effort Allocation

Month	Number of Weekdays*	Number of Weekend Days*	Sampling Plan Weekdays	Sampling Plan Weekends
January	20	11	3	3
February	20	9	3	2
March	23	8	4	2
April	20	10	6	3
May	22	9	8	4
June	22	8	7	4
July	20	11	7	4
August	23	8	7	4
September	20	10	6	4
October	21	10	5	3
November	20	10	4	2
December	20	11	3	2

*Allocation in 2000. Allocations in other years may vary slightly.

The 100 days of sampling represent more sampling effort than most similar studies. SCCWRP and MBC (1994), whose study supported a CERCLA risk assessment (SAIC, 1999), conducted 99 days of sampling throughout the year with emphasis on the summer months at multiple sites within Santa Monica Bay, California, an area significantly larger then the Study Area. Using monthly strata, Malvestuto et al. (1978) suggested that 45

sampling days were sufficient to accurately measure catch. Five days were allocated to the winter and the rest to the summer. The sampling specified here is more than twice as much as Malvestuto et al. (1978) suggested and provides more than three times the number of winter days than they allocated. Malvestuto and Knight (1991) suggested that 6-days per month during the summer would accurately estimate total angling effort for a large lake with a convoluted shoreline that precluded complete instantaneous counts. The plan specified here includes almost twice as much summer sampling effort as Malvestuto and Knight (1991) suggested. Newman et al. (1997) showed that a stratified creel survey is highly accurate in comparison with a complete census using 20 hours per week of sampling effort during summer months. The plan specified here has more than three times the sampling effort evaluated by Newman et al. (1997) in the summer months. Because of this large sampling effort, gains in data accuracy and reductions in variance relative to less intensive sampling schemes are expected. In conclusion, using 100 days of sampling effort and optimally allocating these days to the strata as described achieves the relevant DQOs.

E.5. Sampling Times within a Day

The simulation showed that the MSE could be reduced by increasing the sampling effort exerted within a day. In addition, the simulation was used to determine the ability of a sampling plan to lead to a high proportion of contacts with anglers who may use the Study Area. The analysis showed substantial MSE reduction associated with an increase in sampling time from 22 percent to 44 percent of the possible angling starting times for angling trips considered in the simulation. Moreover, because mobilizing an interview team entails large fixed costs and spending additional time on-site has a relatively low marginal cost once the team has been mobilized, a large proportion of the day will be sampled.

This finding is consistent with the findings of Malvestuto and Knight (1991), Lester et al. (1991), and Crow and Malvestuto (1996), all of which, given a fixed amount of total

sampling time, show the importance of applying effort to times of day rather than to the number of days of the year.

The Health and Safety Plan Addendum (HASPA) prepared for the CAS (Appendix G) specifies that no field activity will take place during night hours. For each sampling day, the total number of daylight hours will be determined, and that day's sampling will include half of the daylight hours rounded up to the nearest hour (for example, at the summer solstice, there are approximately 15 hours of daylight; hence, an 8-hour sampling period will be used. In the winter, there are approximately 9 hours of daylight, so a 5 hour period will be used). The half-day sampling period will be randomly selected to either begin at sunrise or end at dusk, thus ensuring complete coverage of all daylight hours and tidal regimes over the course of the study.

This sampling strategy is based on observations made during multiple site visits and sampling activities conducted under the ESP and on the recent site reconnaissance (see Table 3-1) devoted to counting anglers and noting the times and locations where they were present. The reconnaissance (i.e., good summer weather, weekday and weekend) indicated that individuals use the Study Area primarily during the middle of the day. Moreover, they appear to use it much less very early or very late in the day. In addition, there does not seem to be a pattern of fishing related to tides in the Study Area. The chosen sampling strategy is planned to ensure, however, that no daylight hours are missed in the CAS.

E.6. SIMULATION FOR EVALUATING SAMPLING PLANS

The conclusions drawn from the sampling simulation are presented in previous sections of this appendix and in Section 4 of this work plan. In this section, the details of the simulation and its results are presented.

E.6.1. Simulation Structure

The sampling simulation procedure is summarized in the following algorithm.

1. Specify inputs to the model for "truth:"
    - Number of potential anglers
    - For each potential angler, a probability distribution function (PDF) over
        - Visitation to the Study Area on a day
        - Which location to visit in the Study Area if it is visited
        - The arrival time
        - The duration of the visit.
2. Specify input parameters for the sampling model:
    - Number of sampling days
    - Allocation of days to strata
    - Sampling time within a day and selection of start time
    - Selection of starting location and direction of travel.
3. Pick a draw of "true visitation" for each potential angler from the PDFs specified in (1).
4. Pick a draw of sampling days, times, starting time, and direction based on the sampling plan specified in (2). Compute times and locations for interviewers under the draw.
5. Match the outcome of (3) and the outcome of (4) to generate a set of "data" on the number of people counted at each location during a sampling day.
6. Use the data to estimate total visitation to the Study Area over a year.
7. Repeat steps (3) - (6) 5,000 times. This is the sampling distribution of total trips.

8. Compute the MSE by comparing the estimated total number of trips to the "true" number of trips.

9. Repeat steps (2) - (8) 30 times.

10. Average the MSE over the 30 repetitions in step (9).

Each of these steps is now described.

Step 1: Alternative Truths

The first step in the simulation is to generate a hypothetical "true" value for the population parameter. In the sampling simulation, the parameter is the total number of trips taken by a set of individuals to the Study Area. The relative ability of alternative sampling plans to give good estimates of this truth is then examined. This relative ability depends on two things: 1) when and where the person is in the Study Area, and 2) when and where the sampling plan would have interviewers in the Study Area. Therefore, a "truth" is generated which specifies, for each person who is a potential user of the Study Area, the days when he or she visits the Study Area, the place visited in the Study Area, the arrival time for the outing, and the duration of the outing. "True" visitation patterns to the Study Area were generated as a set of draws (one for each potential angler) from strategically-chosen probability distribution functions (PDF) of visitation to the Study Area, one each for the days of visitation, the location, the arrival time, the on-site duration.

All the truths assume there are 25 potential anglers. Not all potential anglers are equally avid visitors to the Study Area. All the truths are based on the assumption that 5 percent of the population is high-avidity, 15 percent is medium-avidity, and 80 percent is low-avidity. Avidity for using the Study Area is expressed as the probability of going on a given day. Thus, the truths assume that there is one high-avidity angler, 4 medium-avid anglers, and 20 low-avidity anglers. These assumptions regarding the number and relative avidity of Study Area anglers are somewhat arbitrary; however, the exact distribution of avidity in the

population of potential anglers is not important to drawing conclusions from the simulation.

The underlying probability distributions generating the alternative truths hold fixed the distribution of on-site arrival times and the distribution of on-site durations. The first of these, the arrival time, is specified as the uniform PDF on the time interval between 5 a.m. and 11 p.m. If a random variable is distributed uniformly on an interval [a,b], the probability of the variable falling in any subinterval [c,d] is the ratio of the lengths of the intervals, i.e.,

$$\text{Prob } \{x \in [c,d]\} = (d - c)/(b - a).$$

The second variable, the on-site duration, is specified as exponential, with mean duration equal to one hour. The exponential cumulative distribution function is given by:

$$\text{Prob}\{ x \leq k\} = F(k) = 1 - \exp[-\gamma k].$$

The number γ is the inverse of the mean duration. The absolute level of mean on-site duration is not critical for our purposes; rather, we are interested in the relative change in MSE for changes in the duration between times interviewers arrive at a site in comparison to the mean duration.

All the truths assigned visitors to one of five sites within the Study Area with equal probability, conditional on trip being taken to the Study Area (the end points to the Study Area are not visitation sites). The truths differ in the probability distribution functions over visitation on a given day. For all the truths, this is computed as the outcome of a binomial random variable. On each day of the year, each individual has a probability of angling in the Study Area on that day. Call this $\pi(i,d)$ for individual i on day d. Suppose that there are I individuals with a positive probability of taking a trip (i.e. there are I potential anglers). The number of trips taken to the Study Area on day d is the number of

"successes" in I independent Bernoulli trials. Let N be a set of days when the probability of taking a trip is the same for all d in N. The number of trips taken by any one individual during those N days is the number of successes in N Bernoulli trials each having probability $\pi(i; d \in N)$. The mean and variance of the number of trips taken by individual i during the N days are:

$$(1) \qquad E(T(i; d \in N)) = N\pi(i; d \in N)$$

$$(2) \qquad Var(T(i; d \in N)) = N\pi(i; d \in N)\{1 - \pi(i; d \in N)\}.$$

The first truth is the most homogeneous. It has two seasons, winter and summer, and two day types, weekends and weekdays. Thus, there are four different probabilities of taking trips. This truth is labeled "Winter/Summer."

The second truth adds peaks of activity during fall and spring to winter/summer. The mean rate of visitation across avidity classes is the same as for summer weekends, but this rate is applied to all days during the peak period. The spring peak period runs from April 15 to May 15, and the fall peak period runs from September 15 to October 15. This truth is meant to capture the possibility that fish populations may increase in the river during spring and fall runs and that these increases lead to increases in visitation to the Study Area. This truth is labeled "Spring/Fall Peaks."

The third truth is the most heterogeneous in terms of intra-year variability of visitation. It is the same as the Spring/Fall Peak truth, but adds weekend/weekday differences in visitation during the peak periods. The peak period weekday visitation is the same as for summer weekdays, but the rate of weekend visitation is higher. This is called the "Spring/Fall/Day" truth.

The probabilities of visitation by avidity class are summarized in Table E-3.

Step 2: Inputs to the Sampling Model

Alternative Allocation of Days to Strata

As described in Section E.1, Plan #1 has one 30-day period of sampling in the winter and one 30-day sampling period in the summer. These periods were selected with equal probability from the three summer and three winter months. The remaining ten months each have two weekend and two weekday days selected at random.

Table E-3 Visitation Probabilities for Simulation

	High Avidity	Medium Avidity	Low Avidity	Weighted Average
Winter/Summer				
Summer weekday	0.15	0.05	0.015	0.027
Summer weekend	0.25	0.125	0.025	0.05125
Winter weekday	0.05	0.0175	0.005	0.009125
Winter weekend	0.1	0.0375	0.01	0.018625
Spring/Fall Peaks				
Summer weekday	0.15	0.05	0.015	0.027
Summer weekend	0.25	0.125	0.025	0.05125
Winter weekend	0.05	0.0175	0.005	0.009125
Winter weekday	0.1	0.0375	0.01	0.018625
Spring/fall peak	0.25	0.125	0.025	0.05125
Spring/Fall/Day Peaks				
Summer weekday	0.15	0.05	0.015	0.027
Summer weekend	0.25	0.125	0.025	0.05125
Winter weekend	0.05	0.0175	0.005	0.009125
Winter weekday	0.1	0.0375	0.01	0.018625
Spring/fall peak weekday	0.15	0.05	0.015	0.027
Spring/fall peak weekend	0.5	0.25	0.05	0.1025

The following tables display the allocations of days to strata for the Plan #2 and Plan #3 sampling designs. Table E-4 provides the data from the Three Rivers Study on visitation by seasonal and day strata. In Table E-5, are presented alternative strata allocations for the

sampling simulation. The first column of Table E-5 uses the Three Rivers data on standard deviations by season and day type, and the theoretically-optimal allocation to derive a minimum-variance allocation of 100 total sampling days to the eight strata. Since the Three Rivers Study data had no trips on winter weekdays, the optimal allocation allocates zero sampling effort to this stratum. This result was modified to allocate some effort to winter weekends. The modified result is shown in the second column of Table E-5.

The Neyman-optimal allocation of days to strata with equal strata sampling costs is given by (Levy and Lemeshow, 1991)

$$n_h = n(N_h \sigma_{hx} / \sum_h N_h \sigma_{hx})$$

where n is the total sample size, x is the population parameter being estimated, and σ_{hx} is the standard deviation of x in stratum h. We use the standard deviation of the number of trips taken during the strata, namely $N_h\pi(d\in N_h)\{1 - \pi(d\in N_h)\}$ where $\pi(d\in N_h)$ is the average trip-taking propensity in the population of potential anglers (i.e., the weighted average of the trip propensities across avidity groups). The reported standard error in the Three Rivers Study was used an estimate of $[\pi(d\in N_h)\{1 - \pi(d\in N_h)\}]^{1/2}$.

Sampling Times within a Day

The start time of the sampling period was selected randomly from the integer hours between the beginning of possible sampling at 7 a.m. and the end of possible sampling at 8 p.m. minus the length of the sampling period. Hence, with a 4-hour sampling period one of the 10 hour possible start times between 7 a.m. and 4 p.m. was chosen with equal probability, and with a 8-hour sampling period, the times between 7 a.m. and 12 p.m. were selected with equal probability.

Table E-4: Selected Results from the Three Rivers Study

Weekend and Holiday Completed Interviews for the Three Rivers Recreation Study

Season	Sampled Site (-) Periods (+)	Average No. of Completed Interviews Per Site Period (Standard Deviation)	Range in No. of Completed Interviews Per Site Period
Winter *	21	0.33 [0.86]	0 - 3
Spring**	12	2.67 [3.52]	0 - 11
Summer*			
June	7	3.86 [5.52]	0 - 14
July	11	1.36 [1.63]	0 - 4
August	11	2.64 [4.63]	0 - 15
Fall***	18	0.89 [1.97]	0 - 7
Total	80	1.58 [3.07]	0 - 15

Weekday Completed Interviews for the Three Rivers Study

Season	Sampled Site (-) Periods (+)	Average No. of Completed Interviews Per Site Period (Standard Deviation)	Range in No. of Completed Interviews Per Site Period
Winter *	15	0.00 [0.00]	0 – 0
Spring**	22	0.59 [1.74]	0 - 8
Summer*			
June	5	2.00 [1.58]	0 - 4
July	10	1.10 [1.66]	0 – 5
August	11	1.82 [2.18]	0 – 8
Fall***	19	0.32 [1.00]	0 – 4
Total	82	0.073 [1.56]	0 – 8

+ Site-periods are combinations of fishing sites and 4-hour interview periods.

Table E-5: Alternative Allocations of 100 Sampling Days to Strata

	Three Rivers	Plan #2	Plan #3
Winter Weekends	3	6	7
Winter Weekdays	0	3	18
Spring Weekends	12	12	7
Spring Weekdays	24	21	18
Summer Weekends	15	15	7
Summer Weekdays	25	24	18
Fall Weekends	7	7	7
Fall Weekdays	14	12	18

Starting Timing Marker and Direction

There are five possible timing markers equally spaced along a line in the simulated version of the Study Area between which anglers could be observed, plus the two end points of the Study Area. One of the five sites was selected with equal probability as the starting point for sampling. Then, the direction of travel (right or left) was chosen, again with equal probability. When the end of the Study Area was reached, the process changed direction and moved back along the line. Hence, sites in the middle of the line are visited more frequently than sites at the end of the line. Travel time between sites was set at five minutes for most of the runs, though this can be varied.

Step 3: A Draw of Truth

Based on the PDFs specified in Step 1, a single draw is made from each of these distributions for each of the 25 potential anglers. The result is a set of days the Study Area is visited for each individual throughout the year, and, on each day a visit takes place, a location, arrival time and departure time.

Step 4: A Draw of Sampled Times and Locations

In order to compare the alternative sampling plans, we need to incorporate the fact that a particular set of times and locations for interviewers to be in the Study Area will be obtained as a random draw from a set of possible dates and date-time-place combinations. A single iteration of the sampling plan consists of days drawn from the year according to the probabilities determined by the stratification design. Based on these outcomes, interviewers are at specific locations at specific times for each sampling period.

Step 5: Sample Data

Based on steps 3 and 4, the exact day, time and location that interviewers will be in the Study Area has been determined, as has how many people will be at which locations, when, and on which days. In this step the number of people enumerated on that draw of the sampling plan at each location is determined. The individuals are "tagged" so that outcomes for them across the year can be determined.

Step 6: The Estimate of Trips

In this step an estimator for the population parameter, the total number of trips to the Study Area in a year is specified. For purposes of this simulation, the estimator is the sum of the counted individuals over all sites, divided by the expected number of times an individual is counted on a day. The latter is based on: 1) the sampling period within the day relative to the arrival and departure probabilities, and 2) the interval between times when interviewers are at a location and the duration of time a person spends on the river. This provides a daily count estimate. The daily count estimate is then extrapolated to the full year in a straightforward fashion.

Trip estimates are based on the following estimator. Let $C(i,k,t|\ t \in S)$ be the count at location i on the kth count at that location in the day, on day t, which is in stratum S. Based on the start time, end time and time interval between counts at that location, the

PDFs over truth can be used to compute the probability that an individual who goes to the Study Area is counted n times. Call this p(n). Let there be K counts at a location in a day. Arrival times are uniformly distributed on the interval [0,T], and the cumulative probability distribution function for on-site durations is F(v). Then, given counts at location i at times t(j) for j = 1,...,K, the p(n) can be written as:

$$P(n) = (1/T) \sum_{[j=1,\, j=K-(n-1)]} \int_{[t(j-1),t(j)]} F(t(j+n) - s) - F(t(j+n-1) - s)\, ds.$$

The estimator used for yearly visitation is:

$$C = \sum C(i,k,t|\ t \in S)$$

Based on the data that would be collected on this one draw of the sampling plan, we calculate an estimated total number of trips by the population over a year. This is a point on the sampling distribution of the estimated number of trips over a year.

The estimated value of total yearly trips us subtracted from the simulated true value of the number of trips and the result is squared. This gives the squared deviation of the true number of trips from the sample-based estimate of trips.

Steps 7 and 8: Sampling Plan Iterations

The simulation provides 5,000 points on the sampling distribution. The MSE is the average of the squared deviations of simulated true visitation from sample estimated visitation over these iterations. If C_k is the estimated yearly visitation on iteration k, N is the true number of yearly trips, and there are K iterations, the MSE is computed by:

$$MSE = (1/K) \sum_k [\ N - C_k\ ]^2$$

Steps 9 and 10: Several Draws of Truth

So that sampling plans are not evaluated relative to one particular draw of "truth," each "true" visitation pattern was generated 30 times as repeated draws of "truth" from the underlying probability distribution functions on visitation. The performance of the sampling plans as measured by MSE was then averaged over these 30 iterations.

E.6.2. Simulation Results

In examining these results it should be kept in mind that in the implementation phase of the research, different approaches to estimating trips will be used than the approach used here. The Plan #2 sampling plan will not be implemented exactly as specified in the simulation. The physical details of the Study Area are not the same as the stylized Study Area in the simulation. Therefore, attention should not be directed to the *absolute* level of accuracy of the trip estimates. Rather, gaining some insights from the *relative* accuracy across sampling designs is the focus of this effort.

The results from the simulation regarding the allocation of days to strata are summarized in the Table E-6. The table provides the mean of the true population parameter for the 30 draws from a fixed truth specification, the mean (over 30 repetitions of truth) of the mean (over 5,000 iterations of the simulation) of the sampling distributions, the mean of the standard deviations of the sampling distribution, and the mean of the MSEs of the sampling distribution. These statistics are presented for the 9 combinations of underlying truth and allocations of days to strata.

Table E-6: Simulation Results for Various Survey Scenarios

Average of 30 Truth Iterations

Survey Scenario	TRUTH: Winter/Summer Mean	Std Dev	Trips	MSE	Spring/Fall Peak Mean	Std Dev	Trips	MSE	Spring/Fall/Weekend Peak Mean	Std Dev	Trips	MSE
[illegible]	271.2	164.7	215	31997	292.1	176.8	231	37199	287.1	172.1	225	39264
[illegible]	285.3	111.2	214	18251	296.4	113.8	231	18087	293.5	111.1	224	17928
[illegible]	303.6	104.9	224	18288	309.2	107.4	232	18793	295.8	106.4	227	17052

Standard Deviation of 30 Truth Iterations

Survey Scenario	TRUTH: Winter/Summer Mean	Std Dev	Trips	MSE	Spring/Fall Peak Mean	Std Dev	Trips	MSE	Spring/Fall/Weekend Peak Mean	Std Dev	Trips	MSE
[illegible]	38.2	22.3	10.5	12498	44.2	28.9	15.0	15648	59.5	53.4	11.0	38946
[illegible]	31.7	15.9	13.4	6913	33.0	10.7	16.1	4298	29.5	12.0	13.7	4997
[illegible]	32.1	9.0	13.8	6959	43.1	10.7	15.4	8170	34.1	8.5	15.0	5927

Using the Plan #2 sampling design and the Spring/Fall/Days truth, and using eight hours of sampling effort per day, the average MSE was computed for each of 50, 75, 100, 125, 150, and 365 day total samples. The results are presented in Table E-7.

Table E-7: Scenarios for Survey Plan #2 and the Spring/Fall/Days Truth

# Days in Survey	4-hour surveys Mean	Std Dev	MSE	% Δ MSE	8-hour surveys Mean	Std Dev	MSE	% Δ MSE
50	259.1	129.5	20614		140.9	73.0	8483	
75	260.0	106.1	15222	30.1%	142.1	60.3	6651	24.2%
100	258.8	90.2	11956	24.0%	142.2	51.2	5624	16.7%
125	250.2	78.2	8942	28.8%	136.9	43.9	5540	1.5%
150	259.3	69.4	8693	2.8%	141.8	39.4	4604	18.5%
365	260.2	41.9	5750	40.8%	142.2	22.2	3489	27.6%

The results are depicted graphically in Figure E-1.

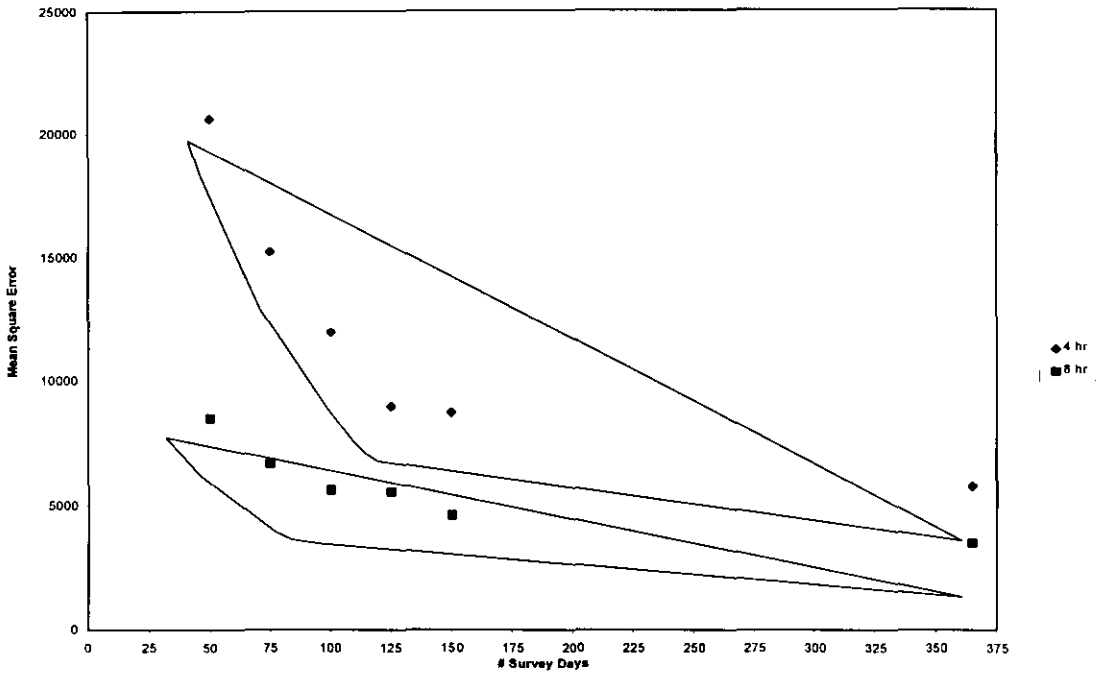


Figure E-1: Mean Square Error for Variations in the Number of Survey Days

The data exhibit a "kink" at 100 days of effort, such that large gains in MSE reduction are realized as total sample days are increased from 50 to 75 and then to 100 days. After this point, an increase in the number of days shows rapidly diminishing returns in MSE reduction.

As well, when 100 days of effort are used, the sampling simulation shows that people with frequent visitation are contacted a high proportion of the time using the Plan #2 sampling plan applied to the Spring/Fall/Week/Weekend truth model. This is shown in Table E-8, where the simulation was conducted with a single draw of truth, rather than averaged over 30 draws. In particular, anglers with high levels of avidity are intercepted with high frequency using 100 sampling days.

Table E-8: Comparison of 4-Hour and 8-Hour Survey Intervals for Plan #2 Scenario and Spring/Fall/Weekend Peaks Truth

	High			
Plan #2	# True Trips	# Times Counted at least Once	avg # counts/48	%
4 hour surveys	48	4852	8.3	97.0%
8 hour surveys	48	4851	9.6	97.0%

	Medium			
Plan #2	# True Trips	# Times Counted at least Once	avg # counts/48	%
4 hour surveys	62	13327	9.4	66.6%
8 hour surveys	62	13305	10.2	66.5%

	Low			
Plan #2	# True Trips	# Times Counted at least Once	avg # counts/48	%
4 hour surveys	87	24346	14.4	24.3%
8 hour surveys	87	24660	15.6	24.7%

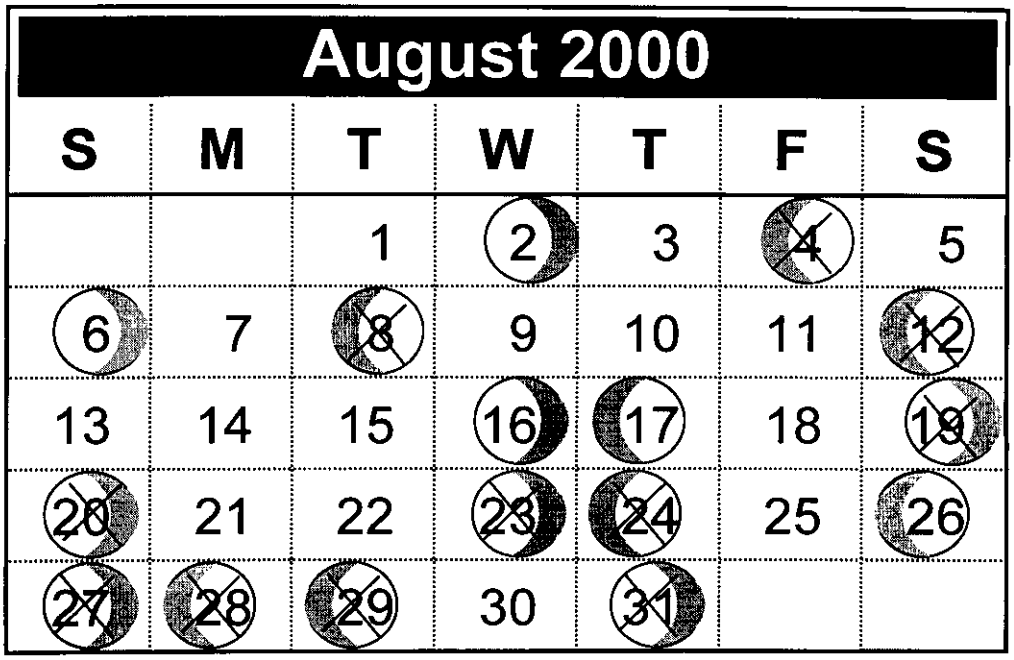
In addition to investigating the effect of changing total sampling effort, increasing sampling effort within the day was examined. The results for increasing effort from 4 to 8 hours in a day are shown in Table E-9. These show significant gains to increasing effort in a day. Since the cost of increasing time on-site is low relative to the cost of mobilizing interviewers on additional days, the implication is that significant on-site time should be expended in the CAS for each day sampled.

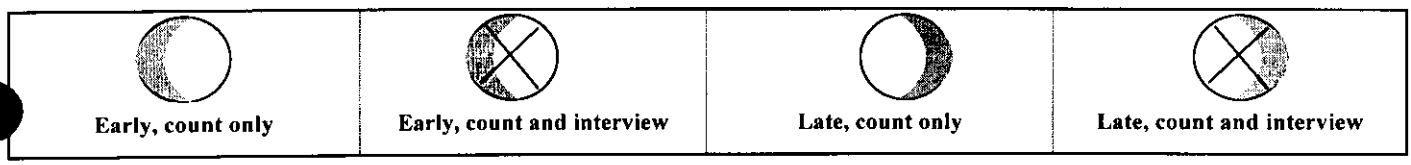
Table E-9: Comparison of 4-Hour and 8-Hour Survey Intervals for Plan #2 and Spring/Fall/Weekend Peak Truth

		Spring/Fall/Weekend Peak			
		Mean	Std Dev	Trips	MSE
Plan #2 4 hr survey-100days	MEAN	293.5	111.1	224	17928
	STDEV	29.5	12.0	13.7	4997
Plan #2 8 hr survey-100days	MEAN	153.8	59.4	226	9389
	STDEV	18.9	7.2	18.9	2972

APPENDIX F. AUGUST–OCTOBER COUNT AND INTERVIEW SCHEDULES

Passaic River Creel/Angler Survey
Shift Schedule – Exit Interviews and Angler Counts

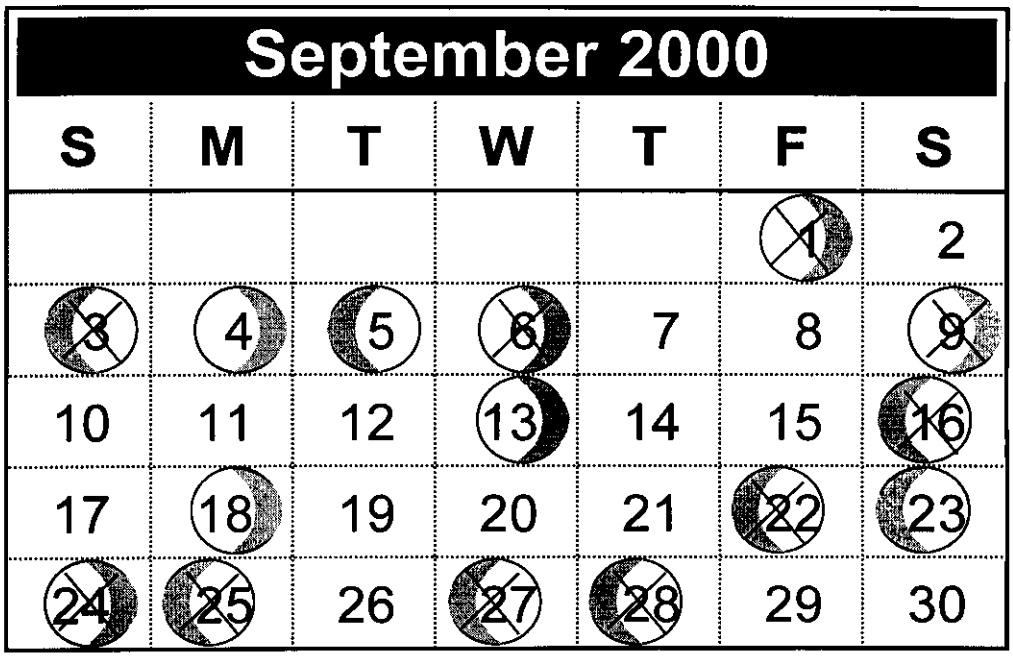




August Exit Interview and Angler Count Shift Schedule

Day	Day of Week	Day Type	Shift Time		Shift Type	Exit Interview Location
2	Wednesday	w_day	Late	1230 - 2030	Count	
4	Friday	w_day	Early	0600 - 1400	Interview	Hess
6	Sunday	w_end	Late	1230 - 2030	Count	
8	Tuesday	w_day	Early	0600 - 1400	Interview	RBP-Kearny
12	Saturday	w_end	Early	0600 - 1400	Interview	Hess
16	Wednesday	w_day	Late	1215 - 2015	Count	
17	Thursday	w_day	Early	0615 - 1415	Count	
19	Saturday	w_end	Late	1215 - 2015	Interview	RBP-Kearny
20	Sunday	w_end	Late	1215 - 2015	Interview	Hess
23	Wednesday	w_day	Late	1215 - 2015	Interview	Hess
24	Thursday	w_day	Early	0615 - 1415	Interview	Hess
26	Saturday	w_end	Early	0615 - 1415	Count	
27	Sunday	w_end	Late	1215 - 2015	Interview	Hess
28	Monday	w_day	Early	0615 - 1415	Interview	Hess
29	Tuesday	w_day	Early	0615 - 1415	Interview	Hess
31	Thursday	w_day	Late	1215 - 2015	Interview	RBP-Kearny

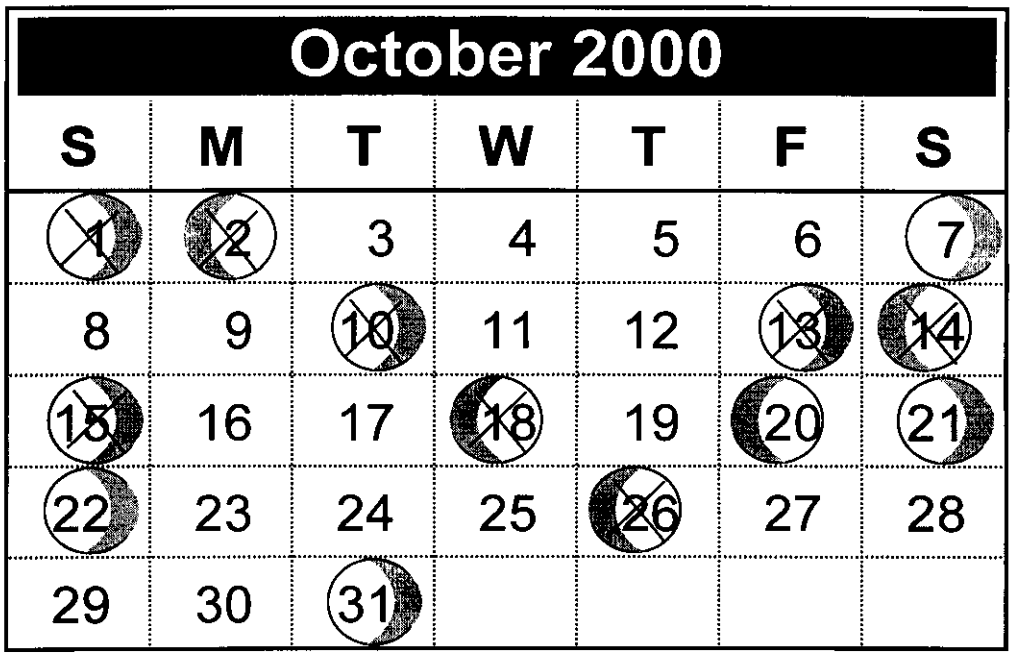
Passaic River Creel/Angler Survey
Shift Schedule – Exit Interviews and Angler Counts

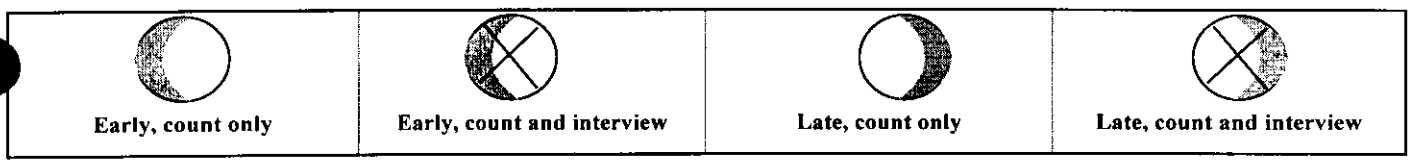


September Exit Interview and Angler Count Shift Schedule

Day	Day of Week	Day Type	Shift Time		Shift Type	Exit Interview Location
1	Friday	w_day	Late	1245 - 1945	Interview	Hess
3	Sunday	w_end	Early	0630 - 1330	Interview	RBP-Kearny
4	Monday	w_day	Late	1245 - 1945	Count	
5	Tuesday	w_day	Early	0630 - 1330	Count	
6	Wednesday	w_day	Late	1245 - 1945	Interview	Hess
9	Saturday	w_end	Late	1245 - 1945	Interview	RBP-Ironbound
13	Wednesday	w_day	Late	1245 - 1945	Count	
16	Saturday	w_end	Early	0645 - 1345	Interview	Hess
18	Monday	w_day	Late	1230 - 1930	Count	
22	Friday	w_day	Early	0645 - 1345	Interview	Hess
23	Saturday	w_end	Early	0645 - 1345	Count	
24	Sunday	w_end	Late	1230 - 1930	Interview	Hess
25	Monday	w_day	Early	0645 - 1345	Interview	Heliport
27	Wednesday	w_day	Early	0645 - 1345	Interview	RBP-Kearny
28	Thursday	w_day	Early	0645 - 1345	Interview	Pathmark

Passaic River Creel/Angler Survey
Shift Schedule – Exit Interviews and Angler Counts





October Exit Interview and Angler Count Shift Schedule

Day	Day of Week	Day Type	Shift Time		Shift Type	Exit Interview Location
1	Sunday	w_end	Late	1230 - 1830	Interview	Hess
2	Monday	w_day	Early	0700 - 1300	Interview	RBP-Newark
7	Saturday	w_end	Late	1230 - 1830	Count	
10	Tuesday	w_day	Late	1230 - 1830	Interview	Hess
13	Friday	w_day	Late	1230 - 1830	Interview	Hess
14	Saturday	w_end	Early	0700 - 1300	Interview	RBP-Kearny
15	Sunday	w_end	Late	1230 - 1830	Interview	Heliport
18	Wednesday	w_day	Early	0715 - 1315	Interview	Hess
20	Friday	w_day	Early	0715 - 1315	Count	
21	Saturday	w_end	Late	1215 - 1815	Count	
22	Sunday	w_end	Late	1215 - 1815	Count	
26	Thursday	w_day	Early	0715 - 1315	Interview	Pathmark
31	Tuesday	w_day	Late	1115 - 1715	Count	

APPENDIX G. HEALTH AND SAFETY PLAN ADDENDUM

G.1. INTRODUCTION

This Health and Safety Plan Addendum (HASPA) is provided as an addendum to the Health and Safety Plan (HASP) prepared for the ESP, and is intended for the field activities that are associated with the Study Area CAS. The content of this HASPA may change or undergo revision based upon additional information made available to field personnel or changes in the scope of CAS work.

G.2. HEALTH AND SAFETY HAZARD ASSESSMENT

Hazards of potential concern in the Study Area for the CAS may be associated with specific sampling activities (i.e., boating or handling fish/shell fish) or unique Study Area conditions (i.e., adverse weather conditions or contact with the public). General hazards in the Study Area are described in Section 5.0 of the HASP. The potential chemical and non-chemical hazards for the CAS are summarized below. The site-specific health and safety requirements and general work practices for conducting the CAS are described in Section G.3 of this HASPA, and in Section 6.0 of the HASP. In general, the overall hazard for the CAS activities proposed in the Study Area is considered low.

G.2.1. Chemical Hazards

As stated in the scope of work, the CAS team is not expected to engage in any field activities that will expose them to the chemicals of concern listed in Section 5.1 of the HASP. No known activities proposed for the CAS will require that the CAS team come into direct contact with sediments or contaminated dust. Exposure to contaminants via the primary exposure pathways of concern (inhalation and skin absorption) is not anticipated. The CAS team will use a dedicated (clean) boat for conducting the on-site survey.

G.2.2. Physical Hazards

The following are the primary physical hazards associated with CAS activities in the Study Area and on the bridges and shorelines along the Passaic River within the Study Area.

Working on the River

A portion of the field program for the CAS will be conducted from a boat on the Passaic River within the Study Area boundaries. The potential exists for personnel to trip or slip and either injure themselves or fall off the boat. Attachment B of the HASP describes the minimum Marine Safety Standards that will be followed during all boating activities for the CAS. Additional information on boating safety requirements is described in Section G.3 of this HASPA.

Tripping Hazard

Personnel will be required to conduct some activities on shorelines or bridges along the Passaic River. Extreme care should be taken whenever walking on shorelines, bridges, or when entering or exiting the boat, especially when equipment is being carried.

Use of PPE

Personal protective equipment (PPE) which may be required for some activities (i.e., boating, adverse weather conditions) places a physical strain on the wearer. When PPE such as gloves, life jackets/vests and rain gear are worn, visibility, hearing and/or dexterity may be impaired.

Heat and Cold Stress

Section 5.2 of the HASP describes heat stress, and provides control measures for avoiding and treating heat stress. Section 5.2 of the HASP describes cold stress, and provides control measures for avoiding and treating cold stress.

G.2.3. Biological Hazards

The following are the primary biological hazards associated with CAS activities in the Study Area.

Insects and Other Animals

During field work, personnel may encounter a wide variety of insects including bees, mosquitoes, ticks and spiders. Field personnel should become familiar with the identification of ticks and other insects, and the prevention, symptoms and treatment of tick and other insect borne diseases. In addition, other animals (e.g., cats, dogs, birds, etc.) may be encountered during field activities. Field personnel will be advised to avoid stray animals, and should be familiar with First Aid and/or procedures for seeking emergency medical treatment which are described in Section 7.0 of the HASP.

Local Flora

Poison Ivy and Poison Oak may be encountered during field activities to which some individuals are more sensitive than others. Field personnel should become familiar with the identification of these flora and avoid contact.

G.2.4. Additional Hazards

Additional hazards which may be encountered during field activities (i.e., handling of fish with sharp fins, lightning, etc.) are described in Sections 6.0 and 7.0 of the HASP.

Information on health and safety requirements for these additional hazards is provided in Sections 6.0 and 7.0 of the HASP and in Section G.3 of this HASPA. Potential hazards associated with intercepting the public for the on-site survey portion of the CAS are discussed below.

Contact with the Public

As part of the on-site survey for the CAS, field personnel will come into contact with the general public. Fishing and shell fishing bans and advisories have been posted for the Study Area. It is possible that some individuals could therefore react negatively to initial attempts by the CAS team to conduct interviews and implement the pre-approved survey instrument. In addition, some portions of the Study Area may be bounded by potentially high crime areas. Moreover, the general population for the CAS may include vagrant individuals who have taken up temporary residence along the shorelines or under bridges along the Passaic River. Finally, due to language differences, local populations may have difficulty in understanding initial introductions or instructions from the CAS team. Each of these factors could contribute to potential negative and/or hostile reactions from anglers in the Study Area.

Every attempt will be made to ensure the safety and protection of the CAS team in the Study Area. General precautions that will be implemented by the field team will include:

- All field activities will be conducted during daylight hours to maximize visibility.
- All field activities will be conducted using a minimum of two person teams (the buddy system), and no attempts will be made to contact the general public by a single member of the field team.

- The CAS team will be clearly identified and/or introduced as individuals conducting a study, rather than local, state or federal regulatory or law enforcement agents.
- Use general precautions and common sense when approaching individuals who are observed or suspected of displaying violent behavior, firearms, or weapons, or who are observed or suspected of being under the influence of alcohol or drugs;
- Keeping all valuable personal items out of direct sight while stored in vehicles or stowed on boats.
- Minimize all physical contact with the general public and their possessions (including any fishing tackle, bait, gear, or items included in their creel).
- Assuring proper maintenance of field vehicles which can be used in emergencies.
- Using appropriate communication devices (i.e., two way radios, portable telephones, etc.) to maintain communication between field team members.
- Alerting local law enforcement officials of the intended study objectives and procedures.
- Alerting supervisors and other appropriate persons of any activities which threaten safety or security.

As necessary, modifications to this HASPA, the HASP, and/or the study design will be made to ensure the safety and protection of the CAS team.

G.2.5. Summary of Potential Hazards

A summary of potential hazards for the CAS is presented below. The anticipated risk is determined without regard for the reduction of risk that will be obtained through the use of

required administrative and engineering controls, or through the use of appropriate PPE. Section 6.0 of the HASP and Section G.3 of this HASPA present the health and safety requirements for field activities and are intended to reduce the potential hazards listed below.

Potential Hazard	Anticipated Risk
Inhalation of contaminated dusts	minimal
Inhalation of volatile contaminants	minimal
Ingestion of contaminants	minimal
Skin/eye contact with contaminated materials	minimal
Tripping hazards	moderate
Confined space entry	not anticipated
Use of PPE	low
Heat stress	depends on ambient temperature
Cold stress	depends on ambient temperature
Electrical hazards	minimal
Insects and other animals	low
Local Fauna	minimal
Boating accidents	moderate
Contact with the general public	moderate

G.3. HEALTH AND SAFETY REQUIREMENTS

This section describes the general health and safety requirements for conducting work in the Study Area, and site-specific requirements for conducting the CAS.

Personal Protective Equipment

The CAS team is not expected to engage in any field activities that will expose them to the chemicals of concern listed in Section 5.1 of the HASP. Therefore, protection from skin hazards is not a requirement in determining the appropriate level of PPE for the on-site survey. Moreover, an increased level of PPE (i.e., Tyvek or nitrile-butadiene rubber

gloves) may increase the potential for negative or aggressive reactions from contact with the public, and could therefore increase the level of risk for the CAS team.

The proposed Level D PPE for the CAS team will include the following:

- Class III Personal Flotation Device (when working on or over water)
- If necessary, latex or vinyl surgical gloves and/or canvas gloves for reducing the potential for penetration injury when handling fish or shell fish
- Appropriate gear for adverse weather conditions (i.e., rain gear).

If an emergency situation arises where one or more members of the CAS team is required to enter known contaminated areas, then appropriate levels of PPE, as described in Sections 5.0 and 6.0 of the HASP, may be required.

Personal Decontamination

Decontamination procedures should not be required by the CAS team because they are not anticipated to engage in any activities which could expose them to contaminants. The CAS team will also use a dedicated (clean) boat for conducting all field efforts, so decontamination of the boat will not be required. In general, the CAS team will practice contaminant avoidance as a primary control for reducing the potential for exposure while traveling in the Study Area. Any gloves (canvas, latex, or vinyl) used to handle fish or crabs as part of the on-site survey should not be considered contaminated, and may either be reused or disposed of in appropriate, non-hazardous, receptacles.

Boating Safety

The CAS will require boat travel on the Passaic River; therefore, the potential exists for personnel to trip or slip and either injure themselves or fall out of the boat. In addition to

the general boating safety guidelines provided in Attachment B of the HASP, the following precautions shall be taken when working on a boat:

- All work in a boat shall be performed by at least a two-person team. Floatation devices, such as life vests, will be worn at all times.
- If work is performed when water temperatures are less than 38°F, appropriate gear (i.e., float coats) and work practices will be employed to reduce chances of exposure.
- No smoking or alcoholic beverages are permitted on the boat. Consumption of food and/or non-alcoholic beverages on the boat is permissible, but will generally be limited to times of prolonged exposure to heat or cold stress.
- No recreational equipment for fishing, hunting, water skiing, or SCUBA diving will be allowed on the boat unless specifically authorized as part of the work-related equipment (e.g., spare fishing rod and tackle may be visible, but not functional, for the purposes of reducing potential negative reactions from the public).

Biological and Other Hazards

Section 6.2 of the HASP describes additional health and safety requirements or guidelines for reducing risks from biological and other hazards which may be encountered in the Study Area.

Study Area Communication

In cases where more than one survey team is conducting field activities, communication between the field teams will be accomplished by one or more of the following means:

- Marine-band VHF two-way radio

- Telephone (portable/cellular) and/or
- Hand-held pagers.

Communication with other field teams on site will be made by telephone.

G.4. EMERGENCY RESPONSE PROCEDURES

Section 7.0 of the HASP describes emergency response procedures for conducting field activities in the Study Area. Members of the CAS team will be expected to be familiar with these procedures, particularly with respect to emergency telephone numbers and emergency routes. In addition to the general guidelines for natural disasters listed in Section 7.1 of the HASP, the field supervisor for the CAS team will have authority to cease all CAS team work in the Study Area if he/she determines that weather conditions pose an unacceptable risk to the field team. All work in the Study Area shall cease if the field supervisor determines that weather conditions are unsafe. Unacceptable weather conditions could include:

- Lightning or a high risk of lightning
- High winds or a high risk of high winds
- Excessive waves
- Excessive precipitation (rain, snow, hail, sleet, etc.) and/or
- Excessive heat or cold.

If an evacuation is called by the field supervisor, all persons will be accounted for before leaving the work area.